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THE NEW INTERNATIONAL ENCYCLOPÆDIA

EDITORS

DANIEL COIT GILMAN, LL. D.
PRESIDENT OF JOHNS HOPKINS UNIVERSITY (1876–1901)
AFTERWARDS PRESIDENT OF THE CARNEGIE INSTITUTION OF WASHINGTON

HARRY THURSTON PECK, PH. D., L. H. D.
PROFESSOR IN COLUMBIA UNIVERSITY

FRANK MOORE COLBY, M. A.
LATE PROFESSOR OF ECONOMICS
IN NEW YORK UNIVERSITY

VOLUME X

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ILLUSTRATIONS IN VOLUME X.

COLORED PLATES

Facing Page
Horses 220
Humming-Birds 314
Indians, American 574
Insects 658
Iris Family 766
Fleur-de-Lis 766

MAPS

Humidity, Average Annual Relative 312
Hungary 322
Idaho 442
Illinois 462
India 526
Indiana 556
Indian Territory 582
International Date-Line 704
Iowa 736
Ireland 750
Iron in the United States 774

ENGRAVINGS

Herring and Shad 20
Hickories 54
Hobbema ("The Avenue of Middleharnis") 116
Hogs, Standard Breeds 128
Hogarth, William ("After the Marriage") 130
Holbein ("The Madonna of the Burgomaster Meyer") 140
Holy Cross Mountain 158
Homer 166
Hornbills and Toucans 214
Horse, Teeth 224
Horse, Evolution 230
Horse-Chestnut 232

164890

FACING PAGE

HORSE-MACKEREL 234
HUDSON RIVER 286
HUGO, VICTOR 294
HUMBOLDT, ALEXANDER VON 306
HUMMING-BIRDS 314
HUXLEY, THOMAS HENRY 352
HYDROPHYTES 380
HYDROPHYTES 382
HYENAS AND PROTELES 388
IGNATIUS LOYOLA 452
IGUANAS AND OTHER AMERICAN LIZARDS 454
HINDU DEITIES 544
IRON AND STEEL—A MODERN BLAST-FURNACE 778
IRON AND STEEL—AN OPEN-HEARTH FURNACE 780

KEY TO PRONUNCIATION.

ā	as in	ale, fate. Also see ĕ, below.
ā̇	" "	senate, chaotic. Also see ĕ, below.
â	" "	glare, care.
ă	" "	am, at.
ä	" "	arm, father.
ȧ	" "	ant, and final *a* in America, armada, etc. In rapid speech this vowel readily becomes more or less obscured and like the neutral vowel or a short u (ŭ).
a	" "	final, regal, where it is of a neutral or obscure quality.
a̤	" "	all, fall.
ē	" "	eve.
ē̇	" "	elate, evade.
ĕ	" "	end, pet. The characters *ĕ*, *ā*, and *ȧ* are used for *ä* in German, as in Gärtner, Gräfe, Hähnel, to the values of which they are the nearest English vowel sounds. The sound of Swedish *ä* is also indicated by *ĕ*.
ẽ	" "	fern, her, and as *i* in sir. Also for *ö*, *oe*, in German, as in Göthe, Goethe, Ortel, Oertel, and for *eu* and *oeu* in French, as in Neufchâtel, Crèvecœur; to which it is the nearest English vowel sound.
e	" "	agency, judgment, where it is of a neutral or obscure quality.
ī	" "	ice, quiet.
ī̇	" "	quiescent.
ĭ	" "	ill, fit.
ō	" "	old, sober.
ō̇	" "	obey, sobriety.
ô	" "	orb, nor.
ŏ	" "	odd, forest, not.
o	" "	atom, carol, where it has a neutral or obscure quality.
oi	" "	oil, boil, and for *eu* in German, as in Feuerbach.
o͞o	" "	food, fool, and as *u* in rude, rule.
ou	" "	house, mouse.
ū	" "	use, mule.
ū̇	" "	unite.
ŭ	" "	cut, but.
ụ	" "	full, put, or as *oo* in foot, book. Also for *ü* in German, as in München, Müller, and *u* in French, as in Buchez, Budé; to which it is the nearest English vowel sound.
û	" "	urn, burn.
y	" "	yet, yield.
B	" "	the Spanish Habana, Córdoba, where it is like a *v* made with the lips alone, instead of with the teeth and lips.
ch	" "	chair, cheese.
D	as in	the Spanish Almodovar, pulgada, where it is nearly like *th* in English then, this.
g	" "	go, get.
G	" "	the German Landtag, and *ch* in Feuerbach, buch; where it is a guttural sound made with the back part of the tongue raised toward the soft palate, as in the sound made in clearing the throat.
H	as *j* in	the Spanish Jijona, *g* in the Spanish gila; where it is a fricative somewhat resembling the sound of *h* in English hue or *y* in yet, but stronger.
hw	"	*wh* in which.
K	"	*ch* in the German ich, Albrecht, and *g* in the German Arensberg, Mecklenburg; where it is a fricative sound made between the tongue and the hard palate toward which the tongue is raised. It resembles the sound of *h* in hue, or *y* in yet; or the sound made by beginning to pronounce a *k*, but not completing the stoppage of the breath. The character K is also used to indicate the rough aspirates or fricatives of some of the Oriental languages, as of kh in the word Khan.
n̲	as in	sinker, longer.
ng	" "	sing, long.
N	" "	the French bon, Bourbon, and *m* in the French Etampes; where it is equivalent to a nasalizing of the preceding vowel. This effect is approximately produced by attempting to pronounce 'onion' without touching the tip of the tongue to the roof of the mouth. The corresponding nasal of Portuguese is also indicated by N, as in the case of São Antão.
sh	" "	shine, shut.
th	" "	thrust, thin.
TH	" "	then, this.
zh	as *z* in	azure, and *s* in pleasure.

An apostrophe ['] is sometimes used to denote a glide or neutral connecting vowel, as in tā'b'l (table), kăz''m (chasm).

Otherwise than as noted above, the letters used in the respellings for pronunciation are to receive their ordinary English sounds.

When the pronunciation is sufficiently shown by indicating the accented syllables, this is done without respelling; as in the case of very common English words, and words which are so spelled as to insure their correct pronunciation if they are correctly accented. See the article on PRONUNCIATION.

A PARTIAL LIST OF THE LEADING ARTICLES IN VOLUME X.

HEROD.
Professor Melanchthon W. Jacobus.

HERODOTUS.
Professor Paul Shorey.

HEXATEUCH.
Professor Nathaniel Schmidt.

HIEROGLYPHICS.
Professor Christopher Johnston and Professor W. Max Müller.

HISTOLOGY.
Dr. Albert Warren Ferris and Professor John Merle Coulter.

HOLBEIN, HANS.
Dr. George Kriehn.

HOMER.
Professor Paul Shorey.

HOME RULE.
Dr. George Elliot Howard.

HORACE.
Professor Nelson Glenn McCrea.

HORSE, FOSSIL.
Dr. William Diller Matthew.

HORSESHOEING.
Mr. S. J. J. Harger.

HORTICULTURE.
Dr. Alfred Charles True.

HOUSING PROBLEM.
Professor Samuel McCune Lindsay.

HUGO, VICTOR.
Dr. Benjamin Willis Wells.

HYBRIDITY.
Professor Alpheus Spring Packard.

HYDRODYNAMICS.
Professor Joseph Sweetman Ames.

HYDROPHOBIA.
Dr. Albert Warren Ferris and Dr. Frederick R. Bailey.

HYDROSTATICS.
Professor Joseph Sweetman Ames.

HYMNOLOGY.
Mr. Samuel G. Ayres.

HYPNOTISM.
Professor Edward Bradford Titchener.

HYSTERIA.
Dr. Albert Warren Ferris.

ICE INDUSTRY.
Mr. Moses Nelson Baker.

ICELAND.
Mr. Cyrus C. Adams, Professor Dana Carleton Munro, Dr. George Kriehn, Dr. James Wilford Garner, and others.

ICELANDIC LANGUAGE.
Professor William Henry Carpenter.

ICELANDIC LITERATURE.
Professor Daniel K. Dodge.

IDIOCY.
Dr. Albert Warren Ferris.

IGNEOUS ROCKS.
Professor William Herbert Hobbs.

ILLEGITIMACY.
Mr. William Buck Guthrie.

ILLUSTRATION.
Mr. Russell Sturgis.

IMMIGRATION.
Dr. Roland P. Falkner.

IMMORTALITY.
Professor Nathaniel Schmidt.

INCOME TAX.
Dr. Alvin Sydney Johnson.

INDEX.
Mr. Charles Alexander Nelson and Dr. Melvil Dewey.

INDIA.
Mr. Cyrus C. Adams, Professor A. V. W. Jackson, Dr. Louis H. Gray, Dr. George Elliot Howard, and others.

INDIAN ART.
Professor Arthur L. Frothingham.

INDIAN LANGUAGES.
Professor A. V. W. Jackson.

INDIAN PEOPLES.
Dr. W J McGee.

INDIANS, AMERICAN.
Mr. James Mooney.

INDIGO.
Professor Morris Loeb and Dr. Alfred Charles True.

INDUCTION.
Professor Evander Bradley McGilvary.

INDUCTION COIL.
Professor William Hallock.

INSANITY.
Dr. Albert Warren Ferris.

INSCRIPTIONS.
Professor James Morton Paton and Professor Christopher Johnston.

INSECT.
Professor Alpheus Spring Packard.

INSECTS, FOSSIL.
Mr. Gilbert Van Ingen.

INSURANCE.
Dr. Allan Herbert Willett.

INTEREST.
Dr. Alvin Sydney Johnson, Dr. Roland P. Falkner, Professor Munroe Smith, and Mr. John Daniel Kaps.

INTERNATIONAL LAW.
Professor James B. Scott.

INTERNATIONAL TRADE.
Dr. Roland P. Falkner.

IRON.
Mr. Charles Shattuck Hill, Mr. Moses Nelson Baker, and others.

IRON AND STEEL.
Mr. Charles Shattuck Hill.

IRRIGATION.
Dr. Alfred Charles True and Mr. Moses Nelson Baker.

THE NEW INTERNATIONAL ENCYCLOPÆDIA

HERJULFSON, hĕr'yulf-son. Bjarni. The hero of an ancient Icelandic saga, according to which he was the first Norse discoverer of America. He was the son of Herjulf, one of the early settlers of Iceland. When he grew to manhood he became a sea-rover, and spent most of his time abroad, returning only to pass alternate winters at his father's house. During one of his absences Herjulf removed to Greenland with Eric the Red, and, when Bjarni on his return to Iceland the following year (986) found his father gone, he determined to follow. Three days after he had left Iceland a storm arose and the ship drifted for some time at its mercy. When at last the storm abated, the crew hoisted sail and came to a land covered with trees. As this could not have been Greenland, Bjarni refused to go ashore; so they sailed away, leaving the land on their left. Three times more they made the land, and the third time they found Eric's settlement in Greenland. News of the discovery they had made of a well-wooded country to the southward came to the ears of Leif Ericson (q.v.), son of Eric, and incited him to make his famous voyage to Vinland. Consult Reeves, *The Finding of Wineland the Good* (London, 1890).

HER'KIMER. A village and the county-seat of Herkimer County, N. Y., 81 miles west by north of Albany; on the Mohawk River, the Erie Canal, and the New York Central and Hudson River Railroad (Map: New York, F 2). It has a free library of over 7000 volumes, and the Folts Mission Institute. The village is in a dairying region, and manufactures knit goods, paper, furniture, beds, mattresses, etc. The water-works and electric-light plant are owned by the municipality. Population, in 1900, 5555.

HERKIMER, Nicholas (1715?-77). An American soldier of the Revolutionary War. He was born probably in what is now Herkimer County, N. Y. Nicholas served as a lieutenant of militia in the French and Indian War, and was in command of Fort Herkimer in 1758, when the French attack on German Flats was made. In 1775 he was commissioned a colonel of militia, and was chairman of the Committee of Safety of Tryon County. In the following year he was appointed a brigadier-general of the New York militia, and operated against Sir John Johnson. After Ticonderoga fell into the hands of Burgoyne's advancing army on July 7, 1777, Colonel Saint Leger joined Sir John Johnson at Oswego, and with a mixed force of 1800 British regulars, Tories and Iroquois Indians under Joseph Brant, advanced toward Fort Stanwix (q.v.). The fort was invested on August 3d, and two days later Herkimer, with a force of 800 hastily recruited militia and volunteers, marched to its relief. Apprised by his Indians of the advance of the relieving column, Saint Leger arranged an ambuscade in a swampy ravine at Oriskany. The battle that ensued, perhaps the most obstinate and murderous of the entire Revolution, was indecisive. The Americans held the field and drove their opponents off, but lost a third of their force in dead and wounded, and were too weak to continue the advance. Saint Leger's force, on the other hand, was so crippled and disorganized as to render out of the question both the continuation of the seige and the advance southward. Early in the fight Herkimer had his horse shot under him and his leg shattered by a musket-ball; but, seated on his saddle-bags underneath a tree, he continued calmly to smoke and shout out his commands until the fight was over. Ten days later he died, as a result of an unskillful operation. A monument 85 feet high was erected to his memory on the field of Oriskany in 1884.

HERKOMER, Hubert von (1849—). A genre and portrait painter and etcher of the English school. He was born at Waal, near Landsberg, Bavaria, May 26, 1849. His family emigrated to the United States in 1851, but returned to England in 1857. Herkomer's early life was a struggle with poverty and ill health. He evinced early talent for painting, and in 1865 he studied under Echtler in Munich. In 1866 he studied at South Kensington under Frederick Walker, whose influence is evident in his early works. In 1870 he removed to London, where he soon became famous as an illustrator for the London *Graphic*, as well as for his painting. He was an excellent water-colorist, and became a member of the Royal Society in 1871, but was not made an Academician until 1890. In 1873 he settled at Bushy, Hertfordshire, where in 1881 he established an art school, in which various branches of art besides painting were practiced. In 1882 he visited America, painting a number of portraits and delivering lectures in New York and Boston; he came again in 1883, and in 1885 he opened a studio in Boston. From 1885 until 1895 he was Slade professor of fine arts, Oxford, succeeding John Ruskin. His lectures before the university were published under the title *Etching and Mezzotint in Engraving* (London, 1892). He has been the recipient of many honors in European countries, and has taken three gold medals.

Herkomer's work includes not only oil and water-color painting, but also excellent etchings. He has worked successfully in various branches of applied art, such as wood-carving, wrought-iron work, and architecture, and has also figured as a playwright, actor, magazine writer, musical composer, and singer. His paintings are excellent in drawing and good in color. The best known of them is the "Last Muster," which took the grand medal of honor at the Paris Exposition of 1878. It represents the veterans of Chelsea at prayer in their chapel. Among his other paintings are: "After the Toil of Day" (1873); "Eventide" (1878); "Life, Light, and Melody" (1879); "God's Shrine" (1880); "Der Bittgang" (Bavarian peasants praying for harvest); and "Pressing to the West" (1884), representing the arrival of emigrants at Castle Garden; "Gathering in the Charter House;" "The Magistracy of Landshut" (1893), which he presented to his native town. His portraits are marked by strong characterization and excellent technique. The best include: The "Lady in White," which took the medal of honor at the Berlin Exposition in 1886; the "Lady in Black" (an American girl); the artist's father, Lorenz Herkomer, in the series "Makers of My House;" Wagner (1878); Ruskin (1881); Browning; Tennyson; Archibald Forbes (1882); and Hans Richter (1883). Among his best-known water-colors are: "Im Walde;" "The Wood Cutter's Rest;" "The Poacher's Fate;" and "At the Well." Consult: The articles on "Herkomer," by Dafforne, in the *Art Journal* (1880); Courtney, *Art Annual* (1892).

HERKULESBAD, hĕr'kōō-lās-bät. See MEHÁDIA.

HERLIN, hĕr'lĕn, FRIEDRICH (?-c.1499). A German painter, born in Rothenburg or Nördlingen. He was probably the pupil of Rogier van der Weyden the Elder. At any rate, he painted in the style of that master. There is an altarpiece by him, representing scenes from the life of the Virgin, in the Church of Saint James at Rothenburg; a "Madonna and Saints" in the town hall at Nördlingen; and a "Nativity" in the Church of Saint Blasius at Bopfingen.

HERM (Lat. *Hermes*, from Gk. Ἑρμῆς, connected with Skt. *Sāramēya*, dog of the lower world, from *Saraman*, messenger of Sudra, from *sar*, to run, to flow, to hasten). A pillar, generally surmounted with a head of Hermes or Mercury, erected commonly in many parts of ancient Greece, especially in Attica, where they were used as milestones, Hermes being the god of traffic, roads, and boundaries. Sometimes heads of other divinities, such as Athena and Eros, were combined with that of Hermes. The Romans used them rather for merely decorative purposes than with any religious significance. Many examples are preserved in European museums.

HER'MAN, HENRY (1832-94). An English dramatist and novelist, born in Alsace. He was educated at a military college, emigrated to America, and served in the Confederate Army during the Civil War, losing an eye as a result of a wound received in action. Afterwards he removed to London, and began to write for the stage. His first play, *Jeanne Dubarry*, was produced at the Charing Cross Theatre in May, 1875, and was followed the next year by *Slight Mistakes*, a farce. In November, 1882, was produced his first great success, *The Silver King*, written in collaboration with Henry Arthur Jones, with whom he also wrote *Breaking a Butterfly* (1884) (Ibsen's *Doll's House*) and *Chatterton* (1884). He then wrote *Claudian* with William Gorman Wills (1884), and *The Golden Band* (1887) with Freeman Wills. He also wrote: *For Old Virginia* (1891); *Eagle Joe* (1892); and *Fay o' Fire* (1885), a romantic opera, for which Edward Jones composed the music. Between 1887 and 1891 he wrote several novels in collaboration with David Christie Murray, such as: *One Traveler Returns* (1887); *A Dangerous Catspaw* (1889); *The Bishop's Bible* (1890); *He Fell Among Thieves* (1890); and *Paul Jones's Alias* (1891). He also wrote alone a large number of novels.

HERMAN, ăr'mäɴ', MARTIAL JOSEPH ARMAND (1749-95). A French revolutionist, born at Saint Pol. He became a lawyer and an ardent revolutionist, and in 1793, when he had laid aside all his earlier counsels of moderation and had become intimate with Robespierre, he was appointed president of the Revolutionary Tribunal, and tried Marie Antoinette, Danton, and many others who died in that year. As Minister of Justice (1794) he had, and used, fresh opportunity for horrible judicial murders. Accused of being bribed by Robespierre in 1794, and of complicity with Fouquier-Tinville (1795), he was condemned on May 6th and guillotined the next day.

HERMANDAD, ăr'mȧn-däᴅ', THE (Sp., brotherhood). The name given to associations formed at various times by the principal cities of Castile, Leon, and Aragon for the defense of their liberties in times of trouble. These confederacies were sanctioned by the sovereigns as agents for suppressing the increasing power of the nobles, and for maintaining public security throughout the land with no cost to the Government. In Aragon the first Hermandad was established in the middle of the thirteenth century, and in Castile about thirty years later. In 1295 thirty-four cities of Castile and Leon formed a confederacy, and entered into a compact by which they pledged themselves to inflict summary punishment upon every noble who had either robbed or injured a member of their association and who refused to make just atonement for the wrong; or upon any one who should attempt, even by the order of the King, to levy an unjust tax. During the long period of anarchy, in which the Christian rulers of Spain were powerless to maintain order in their own dominions, the *Santa Hermandad*, or Holy Brotherhood, presented the only check against the unbounded license of the nobles. Isabella of Castile, seeing the beneficial effects which an extension of the institution was capable of producing, obtained the sanction of the Cortes (1476) for its thorough reorganization and extension over the whole kingdom. A court was established in every community of thirty families, and an appeal from the local court went to the Supreme Council. A general junta met annually, and instructions were transmitted to the provincial juntas. The crimes reserved for the jurisdiction of the Hermandad were all acts of violence and theft committed on the high roads or in the open country, and the penalties attached to each misdemeanor were specified with the greatest precision in the codes of laws which were enacted at different times in the yearly assemblies of the deputies of the confederated cities. An annual contribution was assessed on every hundred householders or *vecinos* for the equipment and maintenance of the horsemen and *quadrilleros*, or officials of the Brotherhood, whose duty it was to arrest offenders and enforce the sentence of the law. Although the Hermandad was regarded with much disfavor by the aristocracy, it continued for some time to exercise its functions, until the country had been cleared of banditti and the ministers of justice enabled to discharge their duties without hindrance from lawless disturbers of the peace. In 1485 the association issued its code of laws, known as the *Quaderno de las leyes nuevas de la Hermandad.* In 1498, the objects of the Hermandad having been obtained and public order established on a firm basis, the functions of the Brotherhood were greatly reduced and most of its officials done away with; in the course of half a century the Hermandad became transformed into a mere police force. Consult: Mariana, *Historia de España* (Valencia, 1783-96); Prescott, *History of Ferdinand and Isabella* (Boston, 1838).

HERMANFRID, hĕr′mȧn-frėt (?-531). The last King of the Thuringians, son of Basinus. He ruled at first with his two brothers, Baderich and Berthar, but, urged on by his ambitious wife, Amalberga, killed Berthar and joined with Theoderich I., King of the Franks, against Baderich, who was defeated and dethroned in 516. Hermanfrid now refused to give up half of his kingdom, as he had promised, to Theoderich. The latter joined Clotaire I., his brother, and the Saxons, in a grand alliance against Thuringia, and dethroned Hermanfrid in 531. One story says that he was killed by his own armor-bearer. Amalberga went to Italy with her children, the bulk of Thuringia was joined to the kingdom of the Franks, and the Saxons took the northern part. The story of Hermanfrid has been dramatized by Wetzel and by Schlönbach.

HER′MANN. A town and the county-seat of Gasconade County, Mo., 81 miles west of Saint Louis; on the Missouri River and on the Missouri Pacific Railroad (Map: Missouri, E 3). It is the centre of extensive vine-growing interests, and manufactures wine, in which there is an important trade, beer, flour, foundry products, etc. The picturesque scenery of the vicinity attracts many excursionists during the summer. Population, in 1890, 1410; in 1900, 1575.

HERMANN, hĕr′mȧn. The leader of the Cherusci in their celebrated victory over the Roman legions of Varus (A.D. 9). See ARMINIUS.

HERMANN, Count of WIED (1477-1552). Archbishop and Elector of Cologne, born at Wied. He was elected Archbishop of Cologne in 1515, and supported the claims of Charles V., whom he crowned at Aix-la-Chapelle in 1520. The next year, at the Diet of Worms, he strongly opposed heresy, and endeavored to have Luther declared an outlaw, in spite of the fact that he himself was striving to bring about a reform, though within the Church. In 1542 he became an advocate of the new teachings, and in consequence was outlawed by the Emperor and banned by the Pope. The Emperor then secured the election of Adolf of Schaumburg to the Archbishopric, and Hermann withdrew to his Earldom of Wied, where he died a few years later. Consult Varrentrapp, *Hermann von Wied und sein Reformationsversuch in Köln* (Leipzig, 1878).

HERMANN, FRIEDRICH BENEDIKT WILHELM VON (1795-1868). A German political economist. He was born in Bavaria, and studied at the universities of Erlangen and Würzburg. His attention was early directed to mathematics and political economy. In 1823 he became privat-docent at the University of Erlangen; in 1825 he was called to the professorship of mathematics at the Gymnasium of Nuremburg; and in 1827 he became professor extraordinary of *Kameralwissenschaften* in the University of Munich. His great work, *Staatswirtschaftliche Untersuchungen,* which appeared in 1832, ranks as one of the most important contributions to German economics. In 1835 he was made member of the Royal Bavarian Academy of Science. He was inspector of technical instruction in Bavaria; in 1845 was appointed one of the Councilors to the Minister of the Interior; and in 1848 sat as a member for Munich in the National Assembly at Frankfort, where he was one of the founders of the so-called 'Great-German Party,' which opposed the rise of the hegemony of Prussia; in 1850 he assumed charge of the Bureau of Statistics, and in 1855 he became Councilor of State. He published a large number of pamphlets and papers on political, economic, and industrial subjects, and the annual reports which he published as head of the Bureau of Statistics entitle him to the rank of one of the founders of the science of statistics.

HERMANN, GOTTFRIED (1772-1848). A German philologist. He was born at Leipzig, November 28, 1772; studied there and at Jena, and was made in 1798 professor extraordinary of philosophy at Leipzig. In 1803 he was professor of eloquence, becoming in addition professor of poetry in 1809, and in this position he remained till his death, December 31, 1848. The first department which he began to cultivate on original principles was metre, of which he attempted to develop a philosophical theory from the categories of Kant; and on this subject he wrote, besides his *Handbuch der Metrik* (1798), several Latin treatises, among which his *Epitome Doctrinæ Metricæ* (1818) reached a third edition in 1852. Of wider importance, however, was the new method which he introduced into the treatment of Greek grammar. The principles of this method are not only explicitly developed in his *De Emendenda Ratione Græcæ Grammaticæ* (1801), but are practically illustrated in his numerous editions of the ancient classics. Hermann's power of dealing with chronological, topographical, and personal questions is shown in his *Opuscula* (7 vols., Leipzig, 1827-30), which also contain some poems. Consult: Jahn, *Gottfried Hermann, eine Gedächtnisrede* (Leipzig, 1849); Köchly, *Gottfried Hermann* (Heidelberg, 1874); Bursian, *Geschichte der klassischen Philologie in Deutschland* (Munich, 1883).

HERMANN, Karl Friedrich (1804-55). A German classical scholar. He was born at Frankfort-on-the-Main, and was educated at Heidelberg and Leipzig. In 1832 he was appointed professor of classical philology at the University of Marburg, and in 1842 succeeded O. Müller as professor of philology and archæology at the University of Göttingen, where he remained until his death. His principal works were his *Lehrbuch der griechischen Antiquitäten* (6th ed. 1882-92), a standard work on Greek antiquities; *Geschichte und System der Platonischen Philosophie* (1839); *Kulturgeschichte der Griechen und Römer* (1857-58); and text revisions of Plato (6 vols., 1851-52); Juvenal's *Satires* (1854); and Persius (1854). Consult Lechner, *Zur Erinnerung an Karl Friedrich Hermann* (Berlin, 1864).

HERMANN, Robert (1869—). A Swiss composer, born at Bern. He studied music at the Frankfort Conservatory in 1891, and with Humperdinck (1893-94). In 1895 the Berlin Philharmonic Orchestra gave his *Symphony in C*, and since that time his compositions have met with increasing favor in Germany. His works include pieces for violin and piano, songs, a concert overture in D minor, quintets, trios, etc.

HERMANNSTADT, hĕr′mån-ståt, Hung. **NAGY-SZEBEN,** nŏd′y'-sĕ′bĕn (Lat. *Cibinium*). An important town of Hungary, formerly the capital of Transylvania, beautifully situated on the Cibin, or Zibin (Hung. *Szeben*), an affluent of the Aluta, about 70 miles west-northwest of Kronstadt (Map: Hungary, J 4). Hermannstadt is the seat of a Greek archbishop and of a Lutheran superior consistory, possesses many fine schools, a library of 40,000 volumes, and a number of fine churches. There are extensive barracks. Tanning, wax-bleaching, and the making of cloth, combs, paper, and gunpowder are among the chief industries. Population, in 1890, 21,500; in 1900, 26,077, of whom two-thirds are Germans and the rest Magyars and Rumanians. Hermannstadt is the principal town in the so-called Saxon Land, and is supposed to have been founded by German colonists in the twelfth century.

HERMANN UND DOROTHEA, o͞ont dō′rō-tā′å. An idyllic poem by Goethe (1797). The plot was suggested by the appearance in Weimar and Eisenach of French emigrants who had been driven from Würzburg by the Bishop. This reminded Goethe of the historic expulsion, in 1731, of several hundred Protestants from his territory by the Archbishop of Salzburg, and on this the poem was based. The scene is laid in a small German town in 1796. Hermann, the son of an innkeeper of the town, meets Dorothea among the exiles and falls in love with her. The opposition of his father is overcome, and after clearing up the misconception of Dorothea, who at first understands that Hermann is seeking her as a servant for his father's household, Hermann wins her love. The poem is in nine cantos and contains 2000 hexameter verses. Goethe acknowledged indebtedness to Voss's *Luise* for the idea of his poem, which, however, surpasses Voss's work in all particulars.

HERMANN VON FRITZLAR, fōn frits′-lär. A German mystic of the fourteenth century. Of his life we know merely that he came from Fritzlar, in Hesse, and that he traveled through Europe, visiting the tombs of the saints. It is surmised that he was a rich layman. He wrote *Die Blume der Schauung*, a speculative work now lost, and a mystical *Heiligenleben*, preserved in a manuscript written under his own supervision. This valuable document for the reconstruction of German mysticism in the fourteenth century is edited by Pfeiffer, in his *Deutsche Mystiker*.

HERMANN VON REICHENAU, rī′κe-nou, Hermann der Lahme, or Hermannus Contractus (1013-54). A German poet and mathematician. He was the son of the Swabian Count Wolverad. From childhood his limbs were painfully contracted, whence the name by which he is generally known. He attended a monastic school at Reichenau, and at the age of thirty joined the brotherhood. He was an earnest and a successful teacher, and drew about him a zealous body of pupils from various places. He wrote a treatise on the abacus (published by Treutlein in the *Boncompagni Bullettino*, vol. x., Rome, 1877); and did much to extend the knowledge of the column computation. Unlike Gerbert (see Sylvester), however, he seems to have had no knowledge of the Hindu numerals. He also wrote on a number-game, 'Rhitmomachia,' and on the use of the astrolabe (q.v.). He is best known, however, for his *Chronicon*, a work on history down to the year of Hermann's death. It was continued by Berthold (edited by Pertz, vol. v. of *Monumenta Germaniæ Historica*, 1844; and translated by Nobbe, 1892). Among his poems are: *De Octo Vitiis Principalibus* (ed. by Dümmler, in *Zeitschrift für deutsches Altertum*, vol. xiii.), and the Latin hymns, *Salve Regina* and *Alma Redemptoris Mater*. Consult Hansjakob, *Hermann der Lahme von der Reichenau* (Mainz, 1875).

HERMANN VON SALZA, zäl′tså (?-1239). A grand master of the Teutonic Order, probably descended from the lords of Salza, in Thuringia. He became grand master in 1210, and raised the Order to an enviable position both in the East and in Europe. He made his headquarters in Venice, though his duties kept him continually traveling in Egypt, Palestine, Italy, and Germany, and several times he acted as arbitrator in the frequent quarrels between the Pope and the Hohenstaufen Emperor Frederick II. Carlyle says of him: "He is reckoned the first great Hochmeister . . . fourth in the series of masters; perhaps the greatest to be found there at all, though many were considerable." Consult: Carlyle, *History of Frederick the Great*, vol. i. (London, 1858-65); Koch, *Hermann von Salza, Meister des Deutschen Ordens* (Leipzig, 1885).

HERMANRICH, hĕr′mån-rīκ (c.269-375). King of the Ostrogoths, variously called Hermanrich, Ermanarich, Ermanrich, and in myth Ermrich. He was the founder of a great Ostrogothic power about the middle of the fourth century, when he conquered many Slavic and Finnish tribes, so that the saga makes him rule from the Black Sea to the Baltic. This story makes him order that Swanhilde, wife of a defeated prince, be torn asunder by horses, for which Hermanrich is slain by her three brothers. According to another tradition he is said to have put an end to his life, at the age of more than a hundred years, when he saw that he was about to be attacked by the King of the Huns, Balamir.

HERMAPH'RODITE (Lat. *hermaphroditus*, from Gk. Ἑρμαφρόδιτος, son of Hermes and Aphrodite, from Ἑρμῆς, *Hermēs*, Hermes + Ἀφροδίτη, *Aphroditē*, Aphrodite). An obsolete term in botany, formerly used to designate those flowers that contain both stamens and pistils, these organs then being regarded as sexual.

HERMAPH'RODITE BRIG. See BRIG.

HERMAPH'RODITISM. See SEX.

HER'MAPHRODI'TUS. The son of Hermes and Aphrodite, born on Mount Ida, where he was brought up by naiads. Going in his fifteenth year to Caria, he rejected the love of Salmacis, the nymph of a fountain in which he bathed. Salmacis prayed to the gods to unite her to the boy forever, and a being resulted half male and half female. The origin of the dual conception is probably to be found in the Cyprian Aphroditus, worshiped in connection with Aphrodite. The form in which Hermaphroditus is represented in art was fixed by Polyclitus. It became a favorite subject for sculpture in the late Greek and Græco-Roman period.

HER'MAS, SHEPHERD OF (Lat., from Gk. Ἑρμᾶς). The title of a work (in Greek), written by a Christian of the second century, who lived in Rome; it is included among the works of the Apostolic Fathers (q.v.). Hermas was a well-to-do freedman, and a brother of Pius, Bishop of Rome about the middle of the second century. He was an earnest, simple-minded Christian, with little education or culture, but typical, no doubt, of many in the Church of his day. Some later writers, like Jerome, confuse him with the Hermas mentioned in Rom. xvi. 14, which is not surprising in view of the fact that he refers to persons and events of the Apostolic age as if they were contemporary. Parts of *The Shepherd* may have been written near the beginning of the second century, but other parts are obviously later, and the work as a whole should probably be dated not long before A.D. 140.

The book takes its name from one of its principal characters, an old man in shepherd's garb, who appears at the close of the first part, and thereafter attends Hermas as a sort of guardian, committing to his charge certain divine commands. The general theme is repentance and the duty of moral strenuousness. The book is divided into (1) five 'Visions,' which form the introduction; (2) twelve 'Mandates,' or commandments respecting the Christian life, and (3) ten 'Similitudes,' or parables, which picture among other things the progress of the Church. The whole forms an important source for our knowledge of second-century Christianity in Rome. Here and there it shows close resemblances to the Epistle of James. Visions and revelations play such an important part in the book that it is properly classed among early Christian apocalypses. A few recent critics hold that it was originally a Jewish book which received Christian revision and enlargement.

For some time after it was written opinion was divided as to whether *The Shepherd* deserved to be classed among the 'Scriptures,' that is, among what we call the canonical books of the New Testament. Irenæus cites from it as 'Scripture,' and Clement of Alexandria and Origen esteemed it highly. It was often read in public worship. Tertullian, on the other hand, speaks slightingly of its moral teaching. In the fourth century it was still held in honor, as Eusebius and Jerome testify, but there was no longer any doubt that it stood outside the sacred canon.

The Greek text, with English translation, has been published by Lightfoot, *Apostolic Fathers*, edited by Harmon (London, 1893). An English translation is given in volume i. of the American edition of *Ante-Nicene Fathers*, edited by Roberts and Donaldson (Buffalo, 1886). In general consult: Cruttwell, *Literary History of Early Christianity*, vol. ii. (London, 1893); Krüger, *History of Early Christian Literature* (New York, 1897); Taylor, *The Shepherd of Hermas* (New York, 1901).

HERMENEGILD, hĕr'me-ne-gĭld (c.560-c.610). Son of Leovigild, King of the Visigoths, and centre of a Catholic legend. In 580 he rebelled against his father to induce him to become a Catholic, says the story, although there is no evidence that Hermenegild was a Catholic apart from the fact that he married Ingunthis, daughter of Sigibert and Brunhilde, who was orthodox. The son was defeated by his father and driven into exile. The legend makes him martyred by his father, whose second wife was an Arian. He was canonized by Pope Sixtus.

HER'MENEU'TICS. See EXEGESIS.

HERMENGYLD, hẽr'mĕn-gĭld. The constable's wife, in Chaucer's *Man of Law's Tale*. Constance is falsely accused of her murder.

HERMES, hẽr'mēz. See MERCURY.

HERMES, hĕr'mĕs, GEORG (1775-1831). A German Roman Catholic theologian and philosopher, born in Dreyerwalde, Westphalia. His student life was passed in Münster, where he afterwards taught at the gymnasium (1798-1807), and lectured with marked success at the Academy (1807-19). In 1799 he was ordained to the priesthood. In 1819 he was called to the University of Bonn, where he spent the remainder of his life. As a professor of theology Hermes achieved the distinction of being the founder of a 'school,' known after him as the Hermesians. It was not long before all his colleagues at Bonn recognized him as their leader. It is said that his influence was sufficient to prevent the appointment of Möhler and Döllinger to professorships there. In Breslau, too, he gained many adherents. Spiegel, Archbishop of Cologne, was an active and powerful supporter of the new movement, and until his death (1836) the Hermesians were in high favor throughout the provinces of the lower Rhine. There seems to have been no doubt of their orthodoxy or of their loyalty to Catholicism, and so long as Hermes lived hardly a sign of opposition appeared. He died in 1831, at peace with the Church, and generally recognized as one of the foremost leaders of German Catholicism.

Four years later (1835), to the astonishment of the Hermesian party, Pope Gregory XVI. issued a brief, condemning Hermes's teaching and prohibiting his writings. The brief declared that many complaints had reached the ears of the Pontiff, and that after careful examination Hermes's works had been found erroneous, scandalous, and injurious to faith. The sections especially objectionable related to the nature of faith and of divine revelation, the authority of Scripture and tradition, the necessity of grace, the evidence of God's existence, and the idea that through reason men could gain a knowledge of supernatural truth. Such teaching was declared to lead toward skepticism and indifference.

Since the year 1832 the party had had an organ, the *Zeitschrift für Philosophie und katholische Theologie*. In its columns and elsewhere defenses at once began to appear. The Hermesians declared that the Pope had been misinformed by persons who were ignorant of philosophy and theology alike. It was freely admitted that the doctrines specified in the Papal brief were heterodox, but it was alleged that these were not the doctrines of Hermes; that neither he nor his school had ever held or taught them. At this point the similarity of their defense to that adopted long before by the Jansenists should be noticed. So confident were they that the Pope was wrong that two of the Bonn professors (Braun and Elvenich) undertook a mission to Rome to persuade him to withdraw the brief. They found, however, that their hopes were baseless, and they were forced to return without having accomplished anything. About 1838 philosophical criticism began to add its strength to the opposition which had already developed in other quarters, and the decline of Hermesianism was rapid. The two Bonn professors, Braun and Achterfeldt, who had been most active in defense of Hermes's memory, retired in 1844. They were not subjected, however, to any ecclesiastical censure. Before the middle of the century the whole movement had become a matter of history.

Hermes's writings are few. Their titles are: *Ueber die Wahrheit des Christentums*, which appeared in 1805; *Einleitung in die christkatholische Theologie*, in two parts (1819 and 1829); *Christkatholische Dogmatik* (1834) published posthumously under the editorship of Achterfeldt. In general consult: Niedner, *Philosophiæ Hermesii Explicatio* (Leipzig, 1838); Braun and Elvenich, *Acta Romana* (Hanover, 1838); Werner, *Geschichte der katholischen Theologie* (Munich, 1866); Lichtenberger, *History of German Theology in the Nineteenth Century* (Edinburgh, 1889).

HERMES, hĕr′mēz, or **MERCURY REPOSING.** A life-size bronze statue found at Herculaneum, now in the Museo Nazionale at Naples. It represents the youthful messenger of the gods seated and leaning forward with limbs relaxed. The attitude is life-like, and the statue is one of the most famous extant representations of the god.

HERMES CARRYING THE INFANT BAC′CHUS. A masterpiece of Praxiteles, found in 1877 at Olympia, and now preserved in the museum there. The figure of the god is the most perfect example extant of the Greek conception of youthful masculine beauty. Hermes stands leaning his left arm, draped with a cloak, on a tree-stump, and holding the infant god of wine. His right arm is missing, but evidently the raised hand held some object for the babe's amusement.

HER′MESI′ANAX ('Ερμησιάναξ). A Greek elegiac poet, who lived in the time of Alexander the Great, and was a native of Colophon, in Asia Minor. His chief work was *Λεόντιον*, an elegiac poem in three books, addressed to his mistress, Leontium. The fragment of ninety-eight lines of the third book preserved by Athenæus (lib. xiii.) describes, in a somewhat disconnected though not ungraceful style, the love-stories of the poets and sages from Orpheus down to Philetas. Consult the editions by Bailey (London, 1839); by G. Hermann in his *Opuscula* (Leipzig, 1828); and by Bergk, in his *Anthologia Lyrica* (2d ed., Leipzig, 1868); also Bergk, *De Hermesianactis Elegia* (Marburg, 1845); and Susemihl, *Geschichte der griechischen Litteratur in der Alexandrinerzeit* (Leipzig, 1892).

HERME′SIANISM. See HERMES, GEORG.

HERMES OF AN′DROS. A statue in the National Museum at Athens, wrongly so called. It does not represent the god, but is a portrait statue belonging to a tomb, and is considered the best example of this class of statues. It dates from the fourth century B.C.

HERMES, OR A PHILOSOPHICAL INQUIRY CONCERNING UNIVERSAL GRAMMAR. A technical work by James Harris, much influenced by Aristotle. It was published in 1751, and was translated by Thurot in 1796 by order of the French Directory.

HERMES TRIS′MEGIS′TUS. See HERMETIC.

HERMET′IC (ML. *Hermeticus*, relating to Hermes, from *Hermes*, Gk. 'Ερμῆς, Hermes). The ancient Egyptians considered the god Dhouti, or Thoth, identified by the Greeks with their god Hermes, as the patron of literature, and the scribe of the gods. Therefore, several magical and religious texts, partly embodied in the *Book of the Dead* (q.v.), were reputed to have been written by this god with his own hands. As such writings could claim the most direct inspiration, the word Hermetic was applied, in Greek times, to writings of the highest degree of sanctity, and served in a general way to designate all inspired books. Clemens of Alexandria states that the Egyptian priests had to study forty-two (i.e. the number of assessors of Osiris) sacred or Hermetic books, divided into six subjects: sacred law, ritual, science, astrology, hymnology, and medicine. It is questionable if such a canon existed throughout Egypt. The claim that the great medical papyrus discovered by Ebers was one of these Hermetic books has not been substantiated. In early Christian times it was customary to ascribe a certain type of magical and gnostic writings in Greek to Hermes Trismegistus, who lost his divine personality more and more, and came to be regarded as a great magician. These pseudographs often claimed to have been translated from the Egyptian, although they bear a thoroughly Greek character and mostly exhibit un-Egyptian ideas of Jewish, Neo-Platonic, etc., origin. They may, however, have been written in Egypt. The most noticeable product among them is *Hermes Trismegistus* (most recent edition by Parthey, Berlin, 1854). These writings exercised a strong influence upon the various secret sciences; hence the term Hermetic became very popular in alchemy and astrology, and some mediæval writings claim the title of Hermetic books. Hermetic medicine meant the most mysterious and powerful medicine, and the expression 'hermetic sealing,' for the most complete, air-tight closure, has survived to our own day. Consult Dufresnoy, *Histoire de la philosophie hermétique* (Paris, 1742); Baumgarten-Crusius, *De Librorum Hermeticorum Origine atque Indole* (Jena, 1827); Hilger, *De Hermetis Trismegisti Poëmandro* (Leipzig, 1855); Ménard, *Hermès Trismegiste* (Paris, 1866); Pietschmann, *Hermes Trismegistus* (Leipzig, 1875).

HERMIA, hĕr′mĭ-å. An Athenian lady in Shakespeare's *Midsummer Night's Dream.* She is the daughter of Egeus, and is enamored of Lysander.

HERMI′AS (Lat., from Gk. Ἑρμίας, *Hermias,* or Ἑρμείας, *Hermeias*). A slave of Eubulus, tyrant of Atarneus, in Mysia, Asia Minor, whom he subsequently succeeded on the throne (B.C. 347). At Athens he made the acquaintance of Plato and Aristotle. The latter spent some years at the Court of Hermias, but fled when Artaxerxes III. captured the tyrant and put him to death. The philosopher, who was married to one of the relatives of Hermias, erected a statue in his honor.

HERMINJARD, âr′mā′nyär′, AIMÉ LOUIS (1817—). A Swiss author, born at Vevey, Vaud. He was a teacher, and practiced his profession in Russia, Germany, and France, before going to Geneva, where he became a friend of Amiel. His great work, the *Correspondance des réformateurs dans les pays de langue française,* began to appear in 1866 (vol. ix., covering the period 1543-44, in 1897).

HERMIONE, hĕr-mī′ō-nē. (1) The beautiful daughter of Menelaus and Helen, married against her will to Neoptolemus (Pyrrhus), the son of Achilles, in performance of a promise made by her father. According to late tradition, she was carried off by Neoptolemus, who was killed by Orestes, to whom she had already been promised. (2) The much-injured wife of Leontes, the madly jealous King of Sicily, in Shakespeare's *Winter's Tale.* The character is taken from Bellaria, in Greene's *Pandosto.* (3) The scornful love of Pyrrhus and loving mother of Astyanax, in Racine's *Andromaque.* After Andromache has persuaded Orestes to murder Pyrrhus, in the act of ascending the altar with Hermione, the latter becomes Regent of Epirus.

HERMI′ONES, or **HERMIN′ONES.** One of the three great divisions of the German peoples, so named from their mythical progenitor Irminus. They were the oldest, best, and most-powerful of the West-Germanic stock, and their eastern boundary was the Vistula and the Carpathians. Among the nations to whom the name Hermiones applied were the Suevi, the Hermunduri, the Lombardi, the Vandali, the Heruli, and the Quadi. Their early home was about the basin of the Elbe and the Main. Consult Stubbs, *Constitutional History of England,* ch. 1, 6th ed. (Oxford, 1897).

HERMIP′PUS OF SMYRNA (Gk. Ἕρμιππος, Hermippus). A Greek philosopher who lived about B.C. 200. A disciple of Callimachus of Alexandria, he was called ὁ Καλλιμάχειος, the Callimachean. He was the author of Βίοι, a work containing the biographies of all the Greek philosophers, historians, and poets. Though it is repeatedly referred to by later writers, only fragments have been preserved. Consult Müller, *Historicorum Græcorum Fragmenta* (Paris, 1868-83).

HERMIT (from OF. *hermite, ermite,* from Lat. *eremita,* from Gk. ἐρημίτης, *erēmitēs,* hermit, from ἐρημία, *erēmia,* desert, from ἐρῆμος, *grēmos,* quiet; connected with Gk. ἠρέμα, *ērema,* quietly, Goth. *rimis,* quiet, Skt. *ram,* to rest). One of the names given in the early ages, and still more in the later Church, to a class of solitary ascetics, who, with a view to more complete freedom from the cares, temptations, and business of the world, withdrew from the ordinary intercourse of life and took up their abode in natural caverns or rudely formed huts in deserts, forests, mountains, and other solitary places. The hermits of the Middle Ages, like the primitive anchorites, often lived in complete solitude; but a much more common, and, in its influence on the Church, more important form of the institute was that of a community of hermits, each possessing his separate hermitage, but all meeting at stated times for mass, prayer, religious instruction, and other common exercises. The various hermits of this class are regarded as constituting religious orders, and although never attaining to the popularity which distinguished the Franciscans, Dominicans, and other active orders, they have formed, nevertheless, a numerous and not uninfluential element in the spiritual life of the Roman Catholic Church. It would be impossible to enumerate the many small associations of this kind. For some of the more important, see AUGUSTINIANS; CELESTINES; HIERONYMITES; PAULITES.

HERMITAGE, THE. (1) A celebrated palace and museum at Saint Petersburg (q.v.). (2) A garden on the side of a hill overlooking Moscow, Russia, which has become a noted fashionable resort. (3) The name given to Rousseau's retreat in the valley of Montmorency, France. It was built for the philosopher by Madame d'Epinay, and was occupied by him from 1751 to 1757. *La nouvelle Héloïse, Le discours sur l'inégalité des conditions,* and a part of the *Dictionary of Music* were written here. In 1813 Grétry died in this place. (4) An old house near Nashville, Tenn., where Andrew Jackson resided for a great part of his life, and near which he was buried. The mansion is now owned by the State.

HERMIT CRAB. One of a large group of small crabs (q.v.) of the family Paguridæ, having the abdominal or tail segments much more largely developed than in true crabs, but undefended by hard plates, and not forming an organ for swimming. The soft and tender tail requires a protective covering, which the instinct of the hermit crabs leads them to find in some coiled shell of a suitable size. On the slightest alarm the hermit crab retires backward into the shell, guarding the aperture of it with one claw, which is much larger than the other, the hard points of the feet also projecting a little. The whole structure of the animal is adapted to such a habitation. The part which in the lobster becomes a finlike expansion at the end of the abdomen, becomes in the hermit crab an appendage for firmly holding in the shell; and so well does the hermit crab hold that it may be pulled to pieces, but cannot be pulled out. Some species have suckers to render the hold more perfect. They often remain in a single shell for a long time, so that colonies of Hydractinia and other hydroids grow over a large part of it. Often sea-anemones attach themselves to the shells in which hermit crabs live, and thus get the benefit of free and rapid transportation. (See COMMENSALISM.) A Chinese species is said to carry an anemone on its claw, so that when withdrawn into its shell the anemone forms an effectual stopper to the opening. Increase of size, however, renders it necessary for hermit crabs to relinquish their shells and seek new ones from time to time, and when thus engaged they are very interesting animals to watch. They try on shell after shell before finding one that suits them, and they are constantly quarreling savagely over their houses; yet in fact they are great cowards. Hermit crabs are very interesting inmates of the aquarium, but their locomotive habits and their voracity make them unsuitable for an aquarium stocked with valuable animals. They feed on mollusks and other crustaceans, and all the animal garbage of the seashore.

The most common American species (*Pagurus longicarpus*) is an interesting object to every visitor of the seashore, and may be found in abundance wherever little pools are left by the tide on a rocky or shelving coast, from Massachusetts Bay to South Carolina.

This species never reaches a large size, and is usually under an inch in length. It is very gregarious, and large numbers are usually found together. A closely related larger species is *Eupagurus pollicaris*, which is found in shallow water from Massachusetts to Florida, inhabiting the shells of Natica and other gastropods. The common European species, *Eupagurus Bernhardus*, is also found in somewhat deeper water off the northeastern coast of America. In the tropics some interesting forms occur, including one or two of large size. One of the most interesting is the Diogenes crab (*Cœnobita Diogenes*), which is several inches long when fully extended. It lives on land, and is found in the driest places, as active as other forms are in the sea. Allied to the hermit crabs are the palm or robber crabs (*Birgus latro*) of the East Indies, which live in holes in the ground at the foot of cocoanut palms, on the fruit of which they feed. They do not carry a shell with them. See LAND-CRAB.

While the shallow-water hermit crabs are symmetrical behind the thorax, in certain deep-sea forms the abdomen is symmetrical, showing that the ancestors of the ordinary hermit crabs were all symmetrical. *Polycheles Agassizii* of the West Indian seas lives in straight tubes of compacted sand, the abdomen being symmetrical. This also is the case with *Xylopagurus rectus*, living in open tubes of wood or bamboo stem. *Tylaspis anomala*, inhabiting the South Pacific at a depth of 2375 fathoms, has a shortened but symmetrical abdomen, with distinct segments and symmetrical legs. Another form (Chœnopagurus) takes refuge in a sheet or blanket formed by the cœnosarc of a colony of polyps. It also is symmetrical. The polyp (*Zoanthus*) is tucked by the crab under its telson by one end and pulled over its back by the other, and the two animals, crab and polyp, seem incapable of independent existence. (See COMMENSALISM.) Hermit crabs have rarely been found in a fossil state, and then only their claws are found preserved. These have been obtained in the Eocene rocks of Hungary.

Consult: Emerton, *Life on the Seashore* (Salem, 1880); Verrill, *Invertebrates of Vineyard Sound* (Washington, 1874); Arnold, *Sea Beach at Ebb Tide* (New York, 1901); Milne-Edwards et Bouvier, "Description des crustacés de la famille des Pagurieus pendant l'Expédition de la Blake" (*Memoirs Museum of Comparative Zoölogy*, Cambridge, 1893).

HERMITE, ār'mĕt', CHARLES (1822-1901). One of the best-known French mathematicians of the nineteenth century. He was born at Dieuze, Meurthe, and received his early education in the Lycée Louis-le-Grand. He entered the Ecole Polytechnique in 1842, but left at the end of the year, in order to devote his attention exclusively to mathematics. From 1848 to 1876 he was connected with the Ecole Polytechnique in various capacities, and from 1862 to 1873 was maitre de conférences in the Ecole Normale Supérieure. From 1876 until his death he gave his time to the university, where he held the chair of higher algebra (1869-97). He was a member of the Academy of Sciences, and a grand officer of the Legion of Honor (1892). His work was chiefly along the line of theory of functions, in which subject he was for many years the leader in France. His first great work, the one which secured for him his election to the Academy of Sciences, was *Sur la théorie de la transformation des fonctions abéliennes* (*Comptes rendus*, 1855). At about the same time begin his discoveries in the new theory of algebraic forms and in the theory of numbers. His most remarkable memoirs, twenty-six in number, *Sur quelques applications de la théorie des fonctions elliptiques*, appeared in the *Comptes rendus* (1877-82). His memoir, *Sur l'équation du 5ème degré* (1866), may be said to have finally settled the great question of the solubility of the quintic equation to the entire satisfaction of the mathematical world. His memoir *Sur la fonction exponentielle* (1874), in which he proved the incommensurability of *e*, paved the way for Lindemann's proof (1882) of the incommensurability of π. Hermite was a very prolific writer. A substantially complete list of his memoirs may be found in the *Catalogue of Scientific Papers of the Royal Society of London*, vols. iii. and vii. Besides his memoirs, which contain his most valuable contributions, he published a *Cours d'analyse de l'Ecole Polytechnique* (1873; 2d ed. 1894), and assisted Serret in editing Lacroix's calculus (9th ed., Paris, 1881, 2 vols.). Consult articles by Mittag-Leffler and Picard in *Acta Mathematica*, vols. xxiii., xxiv. (Stockholm, 1901-02).

HERMIT HUMMING-BIRD. A name given to a group of humming-birds which agree in having the beaks much curved, and the edge of the mandibles not serrated. The 'true' hermits are of the genus Phaëthornis, whose sixteen species are found from Mexico to Southern Brazil, mostly in the hot lowlands. The 'sickle-billed' hermits of the genus Eutoxeres have the beak greatly bent downward, sometimes describing a full half-circle. The whole group keep themselves secluded in dense forest, whence the name. See HUMMING-BIRD.

HERMIT KINGDOM. A popular name given to Korea (q.v.).

HERMIT THRUSH. See THRUSH.

HERMOC'RATES (Lat., from Gk. Ἑρμοκράτης, *Hermokratēs*) (c.460-407 B.C.). A Syracusan politician and statesman, son of Hermon. His great work was the union of the Siceliots (424), which made possible Syracuse's success when attacked by the great fleet from Athens (415). He was at the head of the aristocratic party, and was opposed by the demagogue Athenagoras. In B.C. 412 he went with a large Syracusan fleet to join the Spartans off the western coast of Asia Minor. Here he was very successful for a time, but lost the battle of Cyzicus, and for this was removed from command and exiled. He then fought against Carthage, and died in his attempt to reinstate himself in Syracuse. His daughter was married to Dionysius in 405.

HER'MODAC'TYL (from Gk. ἑρμοδάκτυλος, *hermodaktylos*, hermodactyl, from Ἑρμῆς, *Hermēs*, Hermes + δάκτυλος, *daktylos*, finger). The name of a medicine that had a high repute among the later Greek and the Arabian physicians as a remedy for gout and rheumatism. It is mentioned by Alexander of Tralles, who flourished A.D. 560; by Paulus Ægineta, who lived a century later; by Avicenna, Serapion, and others. By some of the old writers it was termed *anima articulorum*, or *the soul of the joints*. It is impossible now to speak with certainty of the nature of hermodactyl. Corms, probably of several species of colchicum, are still sold in Greece and in the East under the name of hermodactyls. Different botanists and pharmacologists have referred the corms to *Colchicum illyricum*, *Colchicum autumnale*, *Colchicum variegatum*, *Colchicum bulbocodiodes*, etc. See COLCHICUM.

HERMOGENES, hēr-mŏj'ē-nēz (Lat., from Gk. Ἑρμογένης). A Greek rhetorician, who flourished about A.D. 170, born at Tarsus. His ability as a lecturer won him the favorable notice of the Emperor Marcus Aurelius, who appointed him a public teacher of oratory when he was only seventeen years of age. Between the ages of eighteen and twenty he published his famous *Rhetorio* (Τέχνη Ῥητορική,) which was for centuries regarded as a standard and became the subject of extensive commentaries. At the age of twenty-five his faculties gave way, and he spent the remainder of his life in a state of intellectual impotency. A large part of the *Rhetoric* has survived, and was published by Walz, *Rhetores Græci* (Stuttgart, 1832-36), and by Spengel (Leipzig, 1853-56).

HER'MON. A lofty mountain of Syria, the southern end of the Anti-Lebanon Range, from which it is separated, however, by a deep ravine (Map: Palestine, D 1). It rises to the height of 9166 feet above the level of the sea. Its crown is divided into three distinct peaks, the western one a little lower than the northern and the southern, which are of the same height. These peaks are always covered with ice and snow, and can be seen as far south as the Sea of Galilee. The lower part of the mountain is clothed with forests and a specially rich vegetation, due to the numerous rivulets caused by the melting snow. Hermon was a sacred mountain, and is therefore encircled with ruins of ancient temples, most of which were consecrated to the Baal-worship. It is often referred to in Hebrew poetry. It is also held by tradition to have been the Mount of Transfiguration. It is now called Jebel-esh-Sheikh ('the mountain of the old man'), or Jebel-eth-Thel ('the snow mountain').

HERMON'THIS (Lat., from Gk. Ἕρμωνθις). A city of ancient Egypt on the left bank of the Nile, a little above Thebes. Its Egyptian name was On, and, to distinguish it from other places of the same name, it was called On of the South or On of the god Mont. The local deity was the hawk-headed god Mont (q.v.), and hence the city bore the sacred name of *Per-Mont* (house of Mont), of which the Greek *Hermonthis* is a corruption. It was a very ancient town, but was eclipsed by the rise of its neighbor Thebes. With the decline of Thebes On rose again in importance, and finally, as Hermonthis, became the capital of the district. According to Strabo, Apollo (i.e. Horus) and Zeus (i.e. Mont) were worshiped here, and a sacred bull, called by the Greeks Bacis, was also revered. Of the magnificent buildings which adorned the place in ancient times only scanty ruins now remain. The site is occupied by the modern town of Erment, which contains extensive sugar-refineries.

HERMOP'OLIS, or **HERMUP'OLIS** (Gk. Ἑρμόπολις, city of Hermes). The capital of the Greek nomarchy of the Cyclades, situated on the eastern coast of the island of Syra (Map: Greece, F 4). It consists of the old mediæval town and the newer portion constructed since the Revolution of 1821. The town is lighted by gas, and has a number of educational institutions, including two gymnasia and a theatre. The chief industry is ship-building. Commercially Hermopolis is one of the most important cities of Greece, being one of the chief centres in the trade with the Levant, although its commercial importance has somewhat decreased since the rise of Piræus. Hermopolis is the seat of a number of consular agents, of a Greek archbishop and a Roman Catholic bishop. Population, in 1896, 18,760.

HERMOPOLIS, or **HERMU'POLIS MAG'NA.** An ancient city of Middle Egypt, on the left bank of the Nile, between the river and the Bahr-Yûsuf ('Joseph's Canal'), opposite Antinoë, not far south of the site of the modern Beni-Hassan (q.v.). The Copts called it Shmûn, and the hieroglyphics Khmunu. The village which is on its site bears the name of Ashmunein. The Greek name Hermopolis is derived from the ibis-formed or ibis-headed local god Thoth or Dhouti, who was identified with the Greek Hermes. The city was once very important, but the only remarkable ruin, the portico of a beautiful temple, dating from Ptolemaic times, was destroyed in the middle of the last century. Recently another temple has been discovered there. Another Hermopolis, Hermopolis Parva, is the modern Damanhur in the Delta.

HERMOSILLO, ȧr'mô-sē'lyô. Capital of the State of Sonora, Mexico, situated on the Rio de Sonora, in a fertile valley 90 miles by rail north from Guaymas (Map: Mexico, C 3). It has a cathedral, a library, and a mint, and is an important trading centre for agricultural products. Population, in 1900, 17,618.

HERNÁNDEZ DE CÓRDOVA, ȧr-nän'dȧth dȧ kōr'dô-vä, FRANCISCO. See CÓRDOVA.

HERNÁNDEZ DE OVIEDO Y VALDÉS, dȧ ō'vē-ā'dô ē väl-dās', GONZALO. See OVIEDO Y VALDÉS.

HERNANI, OU L'HONNEUR CASTILLAN, âr'nȧ'nē', ōō lô'nẽr' kȧ'stē'yäN' (Fr., Hernani, or Castilian honor). A romantic five-act tragedy in verse, by Victor Hugo. At its first performance in 1830 at the Théâtre Français, the presence of Hugo's partisans in bizarre costumes gave rise to the 'Battle of Hernani,' a series of personal encounters between the adherents of the Classical and the Romantic schools of French playwrights. The play rests on the love of three suitors, Don Carlos, Ruy Gomez, and the bandit Hernani, for Doña Sol. Hernani, on whose head a reward is set, is surprised with Doña Sol by Ruy Gomez, who shelters him from the pursuit of the King on condition that at the blast of a horn Hernani shall give himself up. In the dénouement Hernani is about to wed Doña Sol, when the horn sounds and the lovers kill themselves. The plot is highly improbable and without historical truth, but is redeemed by great richness of imagery and poetic feeling.

HERNDON, hẽrn'don, WILLIAM HENRY (1818-91). An American lawyer, born in Greensburg, Ky. When he was two years old his parents removed to Illinois. In 1836 he entered Illinois College, but was removed by his father in consequence of the abolition sentiments of the faculty. He studied law, and was admitted to the bar in 1844, when he formed a partnership with Abraham Lincoln, which was dissolved only by the latter's death. In 1855 he was Mayor of Springfield, Ill. In connection with Jesse W. Weik, who assisted in putting into literary form the material he (Herndon) had collected, he published *Herndon's Lincoln: The True Story of a Great Life* (new ed. 1891), which is of especial value for the account it gives of Lincoln's early life and personal habits.

HERNE. A town of Westphalia, Prussia, Germany, 11 miles northeast of Essen by rail. It is the centre of great industrial activity, with coal-mines and manufactures of machinery and gunpowder. It was incorporated in 1897. Population, in 1900, 27,863.

HERNE, JAMES A. (1840-1901). An American actor and playwright. He was born in Troy, N. Y., where after a brief experience 'on the road' he made his appearance, in 1859, with a stock company in *Uncle Tom's Cabin.* Afterwards he played in Baltimore and Washington, and then went to California. He had become a popular actor, both East and West, before he produced his first play, *Hearts of Oak*, in 1878. This was very successful, but his subsequent productions, such as *Drifting Apart* and *Margaret Fleming*, were less fortunate, till in the season of 1892-93 his *Shore Acres* at the Boston Museum made its author famous. It is a rural comedy in which he, as 'Uncle Nat' Berry, presented a character full of honest humor and touching pathos, and the play kept the boards almost without a break for six years. In 1899 he produced *The Rev. Griffith Davenport*, and the following year *Sag Harbor.* Consult Strang, *Famous Actors of the Day in America* (Boston, 1900).

HERNE THE HUNTER. A character in popular tradition, who, it was believed, walked at midnight by an ancient oak in Windsor Forest. In Shakespeare's *Merry Wives of Windsor* (iv., 4), he is described as a spirit, with huge horns on his head, who disturbs the revels of the fairies. He also plays a part in Harrison Ainsworth's romance entitled *Windsor Castle.* Herne's oak, said to have been 650 years old, was blown down in 1863. A young oak was planted on the spot by Queen Victoria.

HERNIA (Lat., rupture). A protrusion, through an abnormal or accidental opening, of any organ from its natural cavity. Although hernia may occur in many parts of the body, the word is usually restricted to signify protrusion of the abdominal viscera. The abdominal viscera are subject to violent pressure from the diaphragm and the muscles of the abdomen. This pressure forces them outward and downward against the walls of the belly; and if at any point these walls are not sufficiently strong to resist this pressure, some portion of the viscera is driven through them, and a hernial tumor is formed. Certain parts of the abdominal walls, especially the inguinal and crural rings, and the umbilicus, being weaker than others, hernia most frequently occurs at these points. In some instances hernia is congenital; as from abnormal deficiency of the walls; in other cases it may arise at any period of life as a result of violent bodily exertion, such as straining in lifting, jumping, etc. Sex, age, and occupation seem to have a marked influence on predisposition to hernia. Men are far more liable (in about the proportion of four to one) to this disease than women, though they are less so to those forms of the affection known as femoral and umbilical hernia.

A hernia is almost always composed of a sac and its contents. The sac is a portion of the peritoneum (q.v.) corresponding to the aperture at which the hernia protrudes. It is pushed forward by the protruding viscus, and forms a pouch. The contents vary greatly, but generally consist of a portion of the small intestine (particularly of the ileum), forming the variety of hernia known as *enterocele.* Omentum is often found in hernial sacs, together with intestine. Besides the viscera, the sac always contains a certain quantity of fluid secreted by its interior. Hernia is divisible (1) into reducible, or returnable into the abdomen, irreducible, and strangulated; and (2) according to its situation, into inguinal, crural, femoral, umbilical, etc. The treatment of *reducible hernia* may be palliative or radical. The palliative treatment consists in the application of a truss (q.v.) to retain the protrusion within the cavity of the abdomen. Each particular kind of hernia requires its special form of truss; and before applying it, the hernia must be reduced by placing the patient on his back, relaxing the muscles by bending the thigh upon the abdomen, and pressing the tumor back in the proper direction. The truss should then be put on, and should be worn during the day. The means that have been contrived to effect a radical cure are too purely surgical for description in these pages. Below the age of puberty, and if the hernia is recent, a radical cure is sometimes effected by wearing the truss for two or three years. In *irreducible hernia* the protruded viscera cannot be returned into the abdomen, but there is no impediment to the passage of their contents or to their circulation. In these cases the patient is often liable to dragging pains in the abdomen and to attacks of vomiting. The treatment consists in avoidance of violent exercise and of constipation, and in wearing a support for the protection of the tumor. Hernia is said to be *strangulated* when a portion of intestine or omentum that is protruded is so tightly constricted that it not only cannot be returned into the abdomen, but has its circulation arrested. This form is highly dangerous, because, if relief is not speedily afforded, the strangulated part becomes gangrenous. The causes of strangulation are various, but the condition most commonly arises from a sudden violent effort, by which a fresh portion of intestine is driven into a preexisting hernia, which it distends to such a degree as to produce this complication. The most prominent early symptoms are flatulence, colicky pains, etc. They are succeeded by vomiting first of the contents of the stomach, then of mucus and bile, and lastly of fæcal matters, owing to inverted peristaltic action. If relief is not obtained, the inflammation that commences in the sac extends to the peritoneum, and the ordinary signs of peritonitis appear. After a variable time comes gangrene or mortification of the part, and the patient speedily sinks. When reduction is impossible, prompt surgical intervention is necessary. The hernia is cut down upon and freed from constricting bands with the knife. Where gangrene has set in in the intestine the diseased portion must be cut away and the ends of the intestine reunited.

HERNICI, ĕr-nē′chē. An old Italian people of Latium. Of Sabine connection, they dwelt in the Apennines between the Trerus and Lake Fucinus. They held out long against the Romans, with whom they at length formed an equal alliance in B.C. 486, but to whom they had to yield in B.C. 306. They received in B.C. 241 the rights of Roman citizens. To the north were the Marsi and the Æqui, while the Volsci were on the south. Their capital was Anagnia.

HERNÖSAND, hĕr′nē-sănd. The capital of the Län of Wester Norrland, Sweden, situated on the island of Hernö, in the Gulf of Bothnia, about two miles south of the mouth of the Angerman River (Map: Sweden, H 5). It is connected by bridges with the mainland. It has a school of navigation and other educational institutions. Its harbor is good, and it has regular steamship communication with the other coast towns. It was founded in 1584 by John III., became a bishop's see in 1772, and capital of the län in 1778. Population, in 1901, 7890.

HE′RO (Lat., from Gk. Ἡρώ). A priestess of Aphrodite at Sestos. At a festival of Aphrodite she was seen and loved by Leander, a youth of Abydos. She returned his love, and received him in her tower on the Hellespont, which he swam nightly, being guided by her lamp. Venturing the passage on a stormy night, he was drowned and the body washed ashore at the tower, whence Hero at once cast herself that she might be united with her lover in death. The story developed in the romantic poetry of the Alexandrian period, and has come down to us in a work of Musæus and in Ovid. It is represented on some late works of art and on Roman coins of Abydos and Sestos. It is also the subject of poems by Marlowe and Schiller, and a drama, *Des Meeres und der Liebe Wellen*, by Grillparzer.

HERO. A Greek mathematician and physicist. See HERO OF ALEXANDRIA.

HERO. The quiet daughter of Leonato and cousin of the gay Beatrice in Shakespeare's *Much Ado About Nothing*. Don John causes her waiting woman to impersonate her in a moonlight interview with him, and thus causes her lover to reject her at the altar, but on the discovery of the deception the marriage is carried out. The story of the slander to which she is subjected is generally omitted in modern productions.

HERO, or HERON, OF AL′EXAN′DRIA. The leading Greek mathematician and physicist of his time. Not only are the dates of his birth and death unknown, but there is great uncertainty as to the century in which he lived. The most recent investigation of the evidence, by Schmidt (1899, work cited below, Bd. 1, p. ix.), leads to the conclusion that he may have lived in the first century A.D., but other writers, who, it must be said, have not considered the question so fully, have usually placed him in the first or even the second century B.C. There is much confusion concerning the works of Hero of Alexandria, there having been no less than eighteen Greek writers of this name. It is, however, fairly certain that he wrote at least thirteen books on mathematics and physics. He seems to have been an Egyptian, and it is certain that his style is not that of a Greek. He contributed little to pure mathematics, his chief work on this subject being the extension of the ancient mathematics so as to allow the consideration of the fourth power of lines. Thus, in his geodesy, *γεωδαισία*, contained in his **Μετρικά**, upon which subject he was the only Greek writer, he gives the well-known formula for finding the area of a triangle with sides, a, b, c, and semiperimeter s, $\sqrt{s(s-a)(s-b)(s-c)}$, a formula known by his name. (The proof is given, possibly an interpolation, in his *Περὶ διόπτρας*.) He seems also to have had some idea of trigonometry, and in his geometry is to be found the first definite use of a trigonometric formula. He asserts in substance, using modern symbols, that if A represents the area of a regular n-gon of side s, and if c be the numerical coefficient by which s^2 must be multiplied to produce A, i.e. so that $A = cs^2$ then must $c = \frac{n}{4} \cot \frac{180^\circ}{n}$. He proceeds to compute c for the values $n=3, 4, \ldots 12$, with considerable accuracy, but his method is unknown. He could also solve the complete quadratic equation $ax^2 + bx = c$, where a, b, c, are positive, but not the general form. Hero is credited with a number of mechanical inventions, including a contrivance for utilizing the force of steam and a fountain which bears his name. Consult: Martin, "Recherches sur la vie et les ouvrages d'Héron d'Alexandrie," in vol. iv. of *Mémoires présentées par divers savants à l'Académie d'Inscriptions* (Série I., Paris, 1854); Hultsch, *Heronis Alexandrini Geometricorum et Stereometricorum Reliquiæ* (Berlin, 1864); Schmidt, *Heronis Alexandrini Opera quæ Supersunt Omnia* (Leipzig, 1899—).

HEROD, hĕr′od (Gk. Ἡρώδης, *Hērōdēs*). The family name of a group of rulers in Palestine, derived from that of its most famous member, Herod the Great. The family had its origin in Antipater, an Idumean of honorable stock, whom Alexander Jannæus (B.C. 104-78) made governor of Idumea. The fact that the Idumeans had been subjugated to John Hyrcanus in B.C. 128, and compelled to embrace Judaism, is the only basis for the claim that the members of the

Herodian line were Jews. In his power and influence, and apparently in his official position in Idumea, Antipater was succeeded by his son of the same name. The latter, with the sagacity which had become characteristic of the family, made the declining fortunes of the Asmonean rule and the rising fortunes of Rome serve his political interests until the real control of the country of the Jews rested in his hand—a control which he strengthened by appointing his two sons Phasael and Herod governors, respectively in Jerusalem and in Galilee. (1) **Herod the Great.** Son of Antipater and Cypros, an Arabian woman; reigned from B.C. 37 to 4. Upon the assassination of Antipater (B.C. 43) there followed a period of intrigue and warfare on the part of the Asmonean Antigonus and the Parthians against the Herodian rule, which resulted in the death of Phasael and the escape of Herod to Rome. There in B.C. 39 he was made King of Judea by Antony, Octavius, and the Senate. It was not, however, until B.C. 37 that he succeeded in putting down the forces opposing him. The first years of his reign (B.C. 37-25) were troublous, owing to the hostility of the Sadducean and Pharisaic parties, and the enmity of the surviving members of the Asmonean house, who secured an ally in Cleopatra of Egypt. Herod ultimately prevailed, partly through murder and confiscation of property, partly through political cleverness and trickery, but mainly through the fall of Antony and Cleopatra before the forces of Octavius. The following years (B.C. 25-13) were prosperous. Herod was free to rule and to indulge his passion for building, the results of which showed themselves in the rehabilitation of such places as Strato's Fortress, and such cities as Samaria, Capharsaba, and Anthedon, renamed by him respectively Cæsarea Palestinæ (q.v.), Sebaste, Antipatris, and Agrippæum. At Jerusalem, Jericho, and Cæsarea he erected theatres, amphitheatres, and hippodromes for the Grecian games established in honor of Augustus. He rebuilt the temple in Jerusalem with the most lavish expenditure of wealth and careful regard for the religious scruples of the people. This munificence was extended even beyond his domains to cities in Syria, Asia Minor, and Greece. Herod also gratified his Hellenizing tastes by inviting and attaching to his Court Greek writers and teachers. With all this he was loyal to the people over whom he ruled, not only bestowing upon them substantial benefits at home, but securing for them large favors in some parts of the Diaspora and significant privileges from Rome. The last years of his reign (B.C. 13-4) were full of misery, occasioned by the ceaseless and complicated political intrigues within his household, which rendered him morbidly suspicious and inflamed his murderous passions to the worst. It was shortly before his death that Jesus was born. On his last visit to Rome Herod obtained consent of Augustus to dispose of his kingdom as he saw fit. A few hours before his death he made a will, in which he gave Judea, including Samaria and Idumea, to Archelaus, with the title of king; Galilee and Perea to Antipas, with the title of tetrarch; and Gaulanitis, Auranitis, Trachonitis, Batanea, and Panias to Philip, with the title of tetrarch. This will was practically confirmed by Augustus, and in spite of disturbances and disorders on the part of the people, who desired to be rid of the Herodian yoke, was ultimately put into effect.—(2) **Archelaus**, ethnarch of Judea, Idumea, and Samaria. Son of Herod the Great and Malthace, a Samarian woman; ruled from B.C. 4 to A.D. 6. Though given title of king by his father's will, Augustus withheld this from him, substituting that of ethnarch. He was the worst of Herod's surviving sons. Of his reign we have no details; but Josephus describes it as violent and tyrannical. After nine years the Jews made such complaints against Archelaus that Augustus banished him to Vienne in Gaul. This accords with the statement of Matthew ii. 22, that Joseph on his return from Egypt with Mary and the Child Jesus, "When he heard that Archelaus was reigning over Judea in the room of his father Herod, was afraid to go thither, and . . . withdrew into the parts of Galilee."—(3) **Antipas** (Herod Antipas), tetrarch of Galilee. Son of Herod the Great and the Samaritan Malthace, younger brother of Archelaus; ruled from B.C. 4 to A.D. 37. Though not much is known of his rule, he seems to have been able to govern his country and to have possessed the family passion for building. In Galilee he remade Sepphoris, afterwards called Dio-Cæsarea, and in Perea, Betharamptha, which he named Livias after the wife of Augustus, and in addition reared the magnificent capital which he named Tiberias, for the reigning Emperor. He seems to have had his father's craftiness, though he apparently lacked his diplomacy, as he certainly did his ability in war. The discarding of his first wife, daughter of the Arabian King Aretas, for Herodias, wife of his half-brother Herod Philip (Mark vi. 17; Matt. xiv. 3), not the tetrarch Philip, brought on a war with Aretas in which Antipas was routed. Later, through the persuasion of Herodias, he went to Rome and demanded of Caligula that he be favored, as Agrippa I. had just been, with the title of king. He was confronted, however, by charges from Agrippa himself, was deposed, and banished by the Emperor to Lugdunum (Lyons) in Gaul. This Antipas is the 'Herod' most frequently mentioned in the New Testament (Matt. xiv. 1; Luke iii. 1; xiii. 31; Acts xiii. 1 et al.). It was he who imprisoned and beheaded John the Baptist (Mark vi. 14-29), and to whom Jesus was sent by Pilate (Luke xxiii. 7-15).—(4) **Philip.** Son of Herod the Great and Cleopatra, a woman of Jerusalem; ruled from B.C. 4 to A.D. 34. The country over which he ruled was north and east of the Sea of Galilee, consequently outside of strictly Jewish territory and inhabited by a predominantly non-Jewish population. It was owing to this fact that Philip was able to carry out a Hellenizing and Roman policy among his people. He had the family passion for building, and founded on the site of Paneas a city which he named Cæsarea, known as Cæsarea Philippi (q.v.), to distinguish it from the larger city on the coast. He also rebuilt Bethsaida, which he called Julias, in honor of the daughter of Augustus. Of his rule nothing is known beyond what may be inferred from Josephus's characterization of the man, as "a person of moderation and quietness" in the conduct of his life and government. He seems to have possessed none of the Herodian ambition, cruelty, or lust. He was married to Salome, the daughter of Herodias, and died without issue.—(5) **Agrippa** (Herod Agrippa). Son of Aristobulus, Herod the Great's son by Mariamne, granddaughter of Hyrcanus, and Bernice, daughter of Salome, Herod's sister, and Castobar; ruled from A.D. 37 to 44. His earlier years were spent in Rome, where he fell into spendthrift habits that finally compelled his retirement to Palestine. In the last years of Tiberius's reign he returned to Rome, and succeeded in securing the appointment by the Emperor to the care of his grandson. He had been friendly with Caligula in his early life, and shortly after the latter's accession received from him the tetrarchies of Philip and Lysanias (viz. Abilene) with the title of king, while the Senate added the honorary rank of prætor. In A.D. 40 he obtained the fortified tetrarchy of Antipas; and in the next year, when Claudius came to the throne, he was given by the Emperor, along with the honor of the consular rank, the additional territory of Judea and Samaria, thus finally securing the whole region over which his grandfather had ruled. The next three years constitute the real period of his rule. For the sake of peace he followed a pro-Jewish policy, which showed itself in a personal piety of almost Pharisaic legalism and an official furtherance of the interests of the Jews, which brought them to regard him as a brother and alienated from him the regard of the Roman element in his population and of the Roman troops in his domains. This Jewish favoritism, no doubt, was the cause of his persecution of the Christians (Acts xii. 1-19). The account of his death given by Josephus (*Antiq.* xviii. 6, 7) is in substantial agreement with that in Acts xii. 20-23.—(6) AGRIPPA II. (Herod Agrippa). Son of Agrippa I. and Cypros; ruled from A.D. 50 to about 100. Because of his extreme youth at the time of his father's death, Claudius was persuaded not to give him the succession. The whole of Palestine thus passed under direct Roman rule. In A.D. 50, however, two years after the death of his uncle Herod of Chalcis, he received the kingdom which had thus been vacated. This he surrendered in A.D. 53, receiving in return the former tetrarchy of Philip, together with that of Lysanias and the domains of Varus. In A.D. 56 Nero added to this the cities of Tiberias and Julias in Galilee and Tarichea in Perea, with surrounding lands and villages. Like all his family, he gave himself to building, improving his capital, Cæsarea Philippi, which he renamed Neronias, and architecturally adorning Berytus (Beirut) in Phœnicia. Unlike his father, he gave no special care to the interests of the Jews—manifesting, in fact, a general indifference to the religious questions of his time, though it was in his rule that the Temple at Jerusalem was finished. He tried to combine Hellenism and Judaism, and placed the effigies of the emperors on his coins. He strove to dissuade the Jews from their war with Rome, and manifested his loyalty to the Emperor even after his Galilean cities had deserted him. In return for this, after the war his territory was extended northward, while in A.D. 75 he had conferred upon him the prætorian rank. He left no children; in fact, it is doubtful whether he ever married. As far as record can be obtained, he died in the third year of Trajan's reign, A.D. 100. His rule was a feeble one. It was before this Agrippa and his sister Bernice that Paul was brought by Festus in Cæsarea, on the eve of his deportation to Rome, as narrated in Acts xxv. 13-xxvi. 32.

HEROD AGRIPPA. See HEROD.

HERO'DAS. See HERONDAS.

HERO'DES AT'TICUS. See ATTICUS HERODES.

HERO'DIAN (Gk. 'Ηρωδιανός, *Hērōdianos*). A Greek historian of the third century A.D. He was a Syrian by birth, but held office under the Roman Government, so that he writes with a practical knowledge of the events which he describes. His history covers the years A.D. 180-238, i.e. from the death of Marcus Aurelius to the accession of Gordianus III. The work was highly valued by later historians, especially the Scriptores Historiæ Augustæ and Johannes Antiochenus, who take long passages from it, and try to imitate its style. The history was first made known to the Western world in the translation of Politianus (1493). The first critical edition was published by Bekker (1826); the best is that of Mendelssohn (Leipzig, 1883). There is an English translation by Hart (London, 1749). Consult Peter, *Die geschichtliche Litteratur über die römische Kaiserzeit*, ii. (Leipzig, 1897).

HERO'DIANS (Gk. 'Ηρωδιανοί, *Hērōdianoi*, adherents of Herod, from 'Ηρώδης, *Hērōdēs*, Herod). A party among the Jews, twice mentioned in the New Testament, and both times in connection with the Pharisees: (1) Mark iii. 6, on the occasion of Jesus' healing of the man with the withered hand in the Capernaum synagogue; (2) Mark xii. 13 (cf. Matt. xxii. 16), on the occasion of placing before Jesus the question about tribute to Cæsar. They were evidently not a religious sect, as the Pharisees and the Sadducees; nor the mere Court and family followers of the Herods, but rather a political party, whose object was the reëstablishment of the Herodian kingdom in the spirit of its traditional policy—the union of Judaism with Hellenism. (See HEROD.) Their connection with the Pharisees, consequently, was not due to any sympathy of ideas with them, but to the instinctive conviction that in the spiritual mission of Jesus lay a danger common to them both. They were not necessarily pro-Roman in their feelings; though, in the nature of things, they would be more kindly disposed to the spirit of the pagan government than to that of the old theocracy, as represented by the Pharisees, or of the new Messianism involved in the religion of Jesus. It is probable that they had more in common with the religiously indifferent Sadducees than with any other Jewish party. Upon such a supposition there may be some bearing in the significant interchange of 'Sadducees' and 'Herod' in Jesus' warnings to His disciples as given in the parallels, Mark viii. 15 and Matt. xvi. 6.

HER'ODIA'NUS, ÆLIUS. A Greek grammarian of the second half of the second century A.D., son of Apollonius Dyscolus. He was born at Alexandria, but afterwards removed to Rome, and there gained the favor of the Emperor Marcus Aurelius, to whom he dedicated his chief work, Καθολικὴ *Προσῳδία*, called also *Μεγάλη Προσῳδία*, a treatise on prosody, syntax, and etymology, in about twenty books. Though he is highly praised by later grammarians, including Priscian, who calls him *maximus auctor artis grammaticæ*, only his treatise on monosyllabic words, *Περὶ Μονήρους Λέξεως*, has been preserved complete. Fragments, however, have been preserved in the citations of other grammarians, and have been edited by Lentz in his *Herodiani Technici Reliquiæ* (3 vols., Leipzig, 1876). Consult: Lehrs, *Herodiani Scripta Tria* (Königsberg, 1848); Hilgard, *Excerpta ex Libris Herodiani* (Leipzig, 1887); and Stephen, *De Herodiani Technici Dialectologia* (Strassburg, 1889).

HERO'DIAS. Daughter of Aristobulus (second son of Herod the Great and Mariamne, granddaughter of Hyrcanus) and Bernice, daughter of Salome, Herod's sister. She was twice married, first to her half-uncle, Herod, called in the Gospels Philip (Mark vi. 17; Matt. xiv. 3), the issue of which marriage was a daughter, Salome, who afterwards became the wife of Philip, another half-uncle of her mother. Doubtless, through the real attachment of love, Herodias left her husband for his half-brother, Antipas—a marriage which, because of its illegality according to the Mosaic law, brought upon the latter the outspoken denunciation of John the Baptist, and so led to that prophet's imprisonment and final execution (Mark vi. 17-29; Matt. xiv. 3-12). It was quite possibly the daughter of this second marriage, bearing her mother's name, who danced before Antipas on the occasion of the festival and allured him to the reckless oath that gave Herodias opportunity to accomplish the death of John. The better reading of Mark vi. 22, "his daughter Herodias," is too plain to be otherwise interpreted; while the term by which she is described, "a little maid," would scarcely apply to a girl as old as Salome must have been at that time. It was Herodias's ambition that led her to urge Antipas to his fatal journey to Rome for the securing of the royal title, though her loyal affection for him made her share his exile. See HEROD.

HEROD'OTUS (Lat., from Gk. Ἡρόδοτος) (c.484-c.424 B.C.). A Greek historian. He was the son of Lyxes and Rhœo or Dryo, and was born about 484 B.C. at Halicarnassus, an originally Doric colony in Southwestern Asia Minor, at that time ruled by a Queen Artemisia under the sway of the Persians. His uncle, Panyasis, was an epic poet; and it was perhaps through him that Herodotus acquired the comprehensive acquaintance with early Greek literature, especially poetry, which is so conspicuous in his writings. His family was a prominent one, and the uncle was put to death about the year 457 for conspiring against the tyrant Lygdamis. Herodotus went into exile, and is said to have made his temporary home in the island of Samos, an ally of Athens and member of the Confederacy of Delos or the Athenian Empire. Between the years 467 and 464 he is believed to have traveled extensively on the shores of the Black Sea, in Thrace, Scythia, Asia Minor, and the Persian Empire, including Egypt. The precise extent, direction, and starting-points of his travels are matters of inference from his writings and of controversy among scholars. He saw in Egypt the skulls lying on the field of a battle fought in 460. He visited Scythia before the year 454. His travels in Greece, and possibly in Southern Italy, fall much later. Halicarnassus having risen against Lygdamis and joined the Athenian Empire, Herodotus, according to one tradition a leader in the uprising, returned and resumed his citizenship. He was, however, soon attracted to Athens, then, about 447, at the height of the age of Pericles, the centre and focus of Hellenic culture. There, or, as a fanciful later tradition has it, at Olympia, he gave 'author's readings' from his unfinished histories, and won the admiration of the greatest minds of Greece, the personal friendship of the poet Sophocles, and, so the story goes, the more substantial reward of ten talents voted by the people. A well-invented story relates that the boy Thucydides, present at one of these readings, burst into tears from stress of emulous emotion, and that the historian complimented the boy's father on this indication of a generous nature. In the year 444 Herodotus, with many other brilliant men, joined the colony which Pericles was founding at Thurii in Southern Italy. His subsequent life is a blank. It was probably devoted to the completion and the final publication of his history. An allusion to the Propylæa, or entrance to the Acropolis, is supposed to prove that he visited Athens so late as 430. Nothing in his histories implies that he survived the year 424. Tradition placed his tomb at Thurii.

Herodotus was called the father of history by Cicero. This means, if anything, that he was the first to compose an artistic and dramatically unified history, although there were historians before him, the so-called logographers, or story-tellers, who continued in prose the work of the garrulous later epic. (See LOGOGRAPHER.) The only one explicitly named by Herodotus is Hecatæus of Miletus, who traveled in Egypt, is mentioned as a prominent adviser of the Ionians during the Ionic revolt, and is thought by some critics to have been the source of much matter that Herodotus gives out as his own. But Herodotus was the first to grasp firmly a great central international theme, and to work up, in due and artistic subordination to it, a vast mass of legendary, local, antiquarian, geographical, and ethnological lore, derived partly from predecessors, but widely supplemented by his own travels and *inquiry* (the original meaning of *history*). This theme was the invasion of Greece by Xerxes, of which his boyhood had perhaps caught the last echoes in the tales told by his townsfolk of the wondrous exploits of Artemisia at Salamis. He apprehended it as the culmination of the eternal conflict between the East and the West which he conceived as beginning with the Trojan War, and of which we have not yet seen the end. It shaped itself to his imagination in a large, dramatic, and religiously edifying way. Its prologue is the evolution of the free States of Greece, and, in antithesis to them, the history and panorama of the barbarian world of ancient monarchies and outlying peoples. Its dramatic culmination is the overthrow of the myriads of Xerxes by the few thousand Greeks at Salamis, Platæa, and Mycale. Its moral is the lesson of the nemesis that waits upon Hybris—upon the insolence of those who, drunk with power, forget the limits of mortality. "For God abases the mighty ones of earth, and suffers none to think proud thoughts save Himself." There are many theories (none of them verifiable) of the order of composition of the different parts of the history, of the digressions, in which it abounds, and of the retouches by which its allusions were brought down to date. But in the final result the general design is so clear both to Herodotus and to the reader, that, despite the bewildering prodigality of anecdote, digression, retrospect, and description, we never lose our sense of a majestic architectural unity, or fail to feel that we are progressing steadily toward a predetermined goal. The nine books named after the muses, into which later grammarians aptly divided the work, fall into natural groups of symmetry or antithesis when viewed in connection with the whole. The first three books deal with centuries of time, and the vast barbarian world: (1) The overthrow of the Lydian kingdom of Crœsus, and, in retrospect, the establishment of the Persian monarchy as the heir of the immemorial empires of the East. (2) Egypt in retrospect and description in connection with the Persian Conquest. (3) The consolidation of the Persian Empire under Cambyses and Darius. The last three books are concerned with ten, or, more strictly, three years of conflict on Greek soil, books vii., viii., and ix. being marked respectively by the battles of Thermopylæ, Salamis, and Platæa. The three intervening books at once link and divide the extremes, and trace the progress of Persia and the interlacing of Greek and Persian interests to the point where the struggle became inevitable. (4) The campaigns of Persia, in Scythia and Libya, with vast geographical and ethnological digressions. (5) The subjugation of the north coast of the Ægean—Thrace and Macedon. The beginnings of revolt among the Ionic cities, with anecdotal digressions on Athens and Sparta that prepare us for the rôle to be assumed by those cities. (6) The revolt of the Ionians aided by Athens and Eretria; its suppression; the avenging mission of Mardonius against Eretria and Athens; his defeat at Marathon.

Herodotus, though an artistic, is not a critical historian. A critical history was possible in that age only to a Thucydides describing on the testimony of documents and eye-witnesses a contemporary war between Greeks. The Greeks of the generation of the Persian Wars were too busy making history to write it, and the tradition of the great struggle was already transfigured by legend and local patriotism when he took it up. Nor could he deal scientifically with the dim legends and inextricably crossed traditions of the East which he gathered on the frontiers of the Greek and barbarian worlds. Fortunately, he did not make the attempt. Ignorant of the languages, unable to decipher the records, if he had applied to the tales told him by dragomans, minor priests, commercial travelers, and Greek mercenaries either his own standards of credibility or ours, he would have deprived us not only of many a delightful story, but of much invaluable information. "It is my business to relate what is told me," he declares, "but I am under no obligation to believe it." He does not believe that the Phœnicians got the noonday sun on their right hand in circumnavigating Africa—but he tells us the story. And, wasting no time on vain critical discussions or pretentious philosophies of history, he contrives to tell us more fascinating stories and interesting facts to the page than any other writer in the world. In view of this and his evident good faith, genial simplicity, and earnest piety, we may disregard the critics who impugn his honesty because his account of a crocodile would amuse a naturalist, and his description of Babylon would not satisfy a Baedeker.

The charm of his seemingly simple, artfully artless, naïve, Ionic style has been celebrated by all critics, ancient and modern. Andrew Lang's entertaining parody in his *Letters to Dead Authors*, gives, by exaggeration, a good idea of it to the English reader. Macaulay's essay "On History" contains a picturesque rhetorical characterization.

Bibliography. De Quincey wrote on what he called the "Philosophy of Herodotus," and his essay on "Style" has a fine digression on Herodotus at Olympia. The chief translation is the classical work of Rawlinson in four volumes with elaborate notes and introduction (London, 1858, often reprinted). The translation of G. C. Macaulay (London, 1890) is well spoken of. Stein's annotated German edition (Berlin, 1901 et seq.) is read chiefly by students. Sayce, *Herodotus*, i.-iii. (London, 1883) deserves attention for his introduction, notes, and appendices. Macan, *Herodotus*, iv., v., vi., with appendices (London, 1892), is rich in historic criticism. Hauvette, *Hérodote: historien des guerres médiques* (Paris, 1894), is an excellent monograph. The volume on Herodotus in *Blackwood's Ancient Classics* is readable. Consult also: Kirchhoff, *Ueber die Abfassungszeit des Herodotischen Geschichtswerks* (Berlin, 1878), and Bauer, *Herodots Biographie* (Vienna, 1878).

HEROES, hē'rōz (Lat. *heros*, from Gk. ἥρως, connected with Lat. *servare*, Skt. *sar*, Av. *har*, to protect). In the older portions of the Homeric poems the heroes are warriors; in the *Odyssey* the word has extended its meaning, and denotes any distinguished character of the stories of the past. In the later time a third meaning prevails, and the 'heroes' are the semi-divine objects of worship. To such heroes the later noble families, or even whole communities, traced their origin, and it seems probable that the original use of the word was to denote the souls of the blessed ancestors. These 'heroes' were commonly regarded as sprung from the union of a god and a mortal. Their cult ritual was like that of the gods, but naturally had closest resemblance to that of the chthonic divinities. Their worship was widespread, and it seems very clear that in the large majority of cases those worshiped in historic times as heroes were originally gods, who had been superseded by the growth of the great personal gods. It was natural that eminent men, who had seemed to possess somewhat of the divine essence, should receive reverence as supernatural beings after death. Such are the cases of Brasidas, Themistocles, and in later times some of the founders of philosophical schools, as Epicurus. From this it seems to have been easy to worship the living, as in the case of Alexander and some of his successors, who were honored as 'savior gods' (θεοὶ σωτῆρες). In Thrace the conception of the heroized dead as heavenly horsemen is common, but the word 'hero' has become the name of a mighty god, to whom dedications are frequent. For the best brief account of the growth and character of the hero-worship in Greece, consult: Usener, *Götternamen* (Bonn, 1896); more elaborate, but in their discussion less satisfactory, Rohde, *Psyche* (2d ed., Freiburg, 1898); Deneken, in Roscher, *Lexikon der griechischen und römischen Mythologie* (Leipzig, 1886-90), with full collection of authorities; and Furtwängler, *Sammlung Sabouroff*, vol. i. (Berlin, 1883).

HEROIDES, hē-rō'ĭ-dēz. An early work of Ovid, a collection of twenty fictitious love-letters sent by noble women of the olden time to their estranged husbands or lovers. The theme in all is the same, but their romantic nature and dramatic setting have placed them among the most popular of Ovid's works. The last six of the epistles are believed to be the work of imitators.

HER'OIN. A derivative of morphine. It is a white, crystalline, neutral, slightly bitter powder. It is only slightly soluble in water, but freely so when a dilute acid is added. The use of the drug in medicine practically dates from 1898, and there is still a diversity of opinion as to its action and value. Its analgesic effect is inferior to that of morphine or codeine, but it may be used as a substitute when these are not well tolerated. It seems to be chiefly of value in allaying cough. For the relief of dyspnœa it is sometimes effectual, having given good results in cases due to asthma, cardiac dilatation, aneurism of the aorta, and uræmia. It has been claimed that heroin is to the respiratory system what digitalis is to the heart. The dose should always be small, and it should be used with the same caution as other derivatives of opium. A single dose of two and one-half grains has been followed by great exhaustion, trembling, diminished temperature, a thready pulse of 140, contraction of the pupil, and impaired vision. Recovery followed the administration of caffeine.

HÉROLD, ā'rō', Louis Joseph Ferdinand (1791-1833). A French dramatic composer, born in Paris. Although his father was a musician, he discouraged his son's musical ambitions, and it was only after his father's death (1802) that the boy was able to follow his natural bent. In 1806 he entered the Paris Conservatory, winning first prize for piano-playing in 1810, and the Prix de Rome in 1812 with his cantata *Mlle. de la Vallière.* After studying in Rome for three years he went to Naples, producing there, in 1815, his first opera, *La gioventù di Enrico Quinto.* His next three or four operas, given in Paris, were successful, but, owing to poor libretti, were followed by a series of failures which for a time discouraged the composer. In 1828 Hérold was elected a member of the Legion of Honor. His best works, *Marie* (1826), *Zampa* (1831), and *Le pré aux clercs* (1832), are compositions of genuine merit, and still hold the boards in France and Germany. Consult Jouvin, *Hérold, sa vie et ses œuvres* (Paris, 1868).

HERON (OF. *hairon, heron,* Fr. *héron,* Prov. *aigron,* heron, from OHG. *heigir,* heron, AS. *higora;* connected with AS. *heagra,* OS. *hreiera,* MHG. *reiger,* Ger. *Reiher,* heron, Skt. *krakana, krakara,* partridge, and Lat. *crocire,* Gk. κρίζειν *krizein,* to screech, Goth. *hrops,* cry, OHG. *hruom. ruom,* Ger. *Ruhm,* fame, AS. *hroc,* Eng. *rook*). A bird of the genus Ardea (and allied genera), of the family Ardeidæ and suborder Herodii. This family includes also bitterns and night-herons. In it the bill is long, compressed, and sharp; the tail short, the legs and the toes long and slender, the wings long. Those peculiar patches of soft, oily feathers called 'powder-down' tracts are always present—three pairs in the true herons, one on the breast, one on the rump, and one under the thighs. In the herons—in which genus are included the species commonly designated egrets (q.v.), which differ only in unimportant particulars of plumage—the bill is slender but strong, forming a compressed and lengthened cone: the plumage is beautiful, but seldom exhibits very gay colors, white, brown, black, and slate-color, finely blended, being generally predominant. Although the sexes usually are alike in color, few birds show greater variety of plumage than the herons, for the breeding plumage is much finer than that of the remainder of the year, and the young are usually very different from the adults. Furthermore, a number of species are dichromatic; that is, some specimens show one type of coloration and other specimens another type, absolutely without regard to age, season, or sex. (See Dichromatism in Birds.) In the herons, one of the color phases is generally pure white; the other phase is more or less colored, and is always remarkably different. (For the use of the plumage of certain herons as an ornament of costume and in millinery, which has led to their extinction in some regions, see Aigret.) The body is small in proportion to the length of the neck and limbs; the neck is long, and, except in flight, is usually held curved. In flight the heron carries the neck, head, and long bill in a straight line before the body, and the long legs in like manner stretched out behind. Herons feed mostly on fish, frogs, and other aquatic animals, and may be seen, particularly very early in the morning and late in the evening, standing patiently motionless in some shallow water, at the margin of a lake or stream, or on the seashore, waiting till prey come within reach. In default of their ordinary food, however, herons sometimes prey on young birds, reptiles, and the smaller mammalia. They usually go forth singly in quest of prey, but are mostly gregarious in their nidification. The nests are usually built in trees, of coarse sticks with little lining. The eggs are three or four, in color blue or bluish green, without spots. See Colored Plate of Eggs of Water and Game Birds.

Herons are widely distributed over the globe, but are especially abundant in the tropics and warm temperate zones. Some seventy-five species are known, of which about a dozen occur in the United States.

The great blue heron (*Ardea herodias*) is about four feet in length from the point of the bill to the end of the tail, and nearly six feet across the wings. It is of a delicate gray color on the upper parts, except the quill-feathers, which are black, and the tail, which is deep slate-color. This common heron generally builds its nest in a high tree, and many nests are sometimes to be seen in a single tree. In northern parts of the continent the heron is known only as a summer bird of passage, but it remains in the Southern United States all the year. Its geographical range extends over most parts of the New World north of the equator. Herons were formerly in great esteem for the table, although now disregarded. The common heron (*Ardea cinera*) of Europe is very similar to the great blue heron, but has the tibiæ white instead of chestnut. It is famous as the game which was most eagerly sought in falconry. Other well-known American herons are the little green heron (*Ardea virescens*), which is only about a foot and a half long, the prevailing colors dark green and brown, abundant throughout the United States and a little beyond, both north and south; the night-heron (*Nycticorax nycticorax,* var. *nævius*), a mere variety of the European night-heron, found throughout the United States and Canada. (See Night-Heron.) The white heron (*Ardea egretta*) and the snowy heron (*Ardea candidissima*) are southern species, always pure white, the former about 60 per cent. larger than the latter; and the reddish egret (*Ardea rufa*), the little blue heron (*Ardea cœrulea*), and the great white heron (*Ardea occidentalis*), all of which are dichromatic; the last is the largest American heron, and is about 4½ feet long and 8 feet in extent. The largest known species is the giant heron of Africa (*Ardea Goliath*), which slightly exceeds these figures. Among other herons of the Old World may be mentioned the following: The purple heron (*Ardea purpurea*), which is of large size, purplish-blue plumage, and wide distribution (see the Colored Plate of WADERS); the great white heron, or great egret (*Ardea alba*), is most common in Turkey and eastward. It is an extremely beautiful bird, with perfectly white plumage, much of it loose and flowing. The little egret (*Ardea garzetta*) has also white flowing plumage. Consult: Newton, *Dictionary of Birds* (London and New York, 1896); Sclater and Hudson, *Argentine Ornithology* (London, 1888); and American ornithologies.

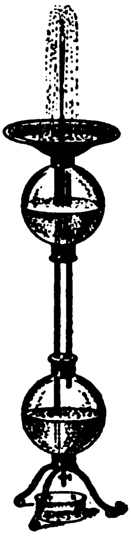
HE'RON. See HERO OF ALEXANDRIA.

HERON, MATILDA (1830-77). An American actress. She was born near Londonderry, in Ireland, and was brought to the United States by her parents in childhood. She first appeared in Philadelphia in 1851 as Bianca in *Fazio*. Her chief parts were Camille in *La Dame aux Camélias*, and Ulah in *De Soto*. She played in all the principal American cities and visited London in 1861. She was married to Robert Stoepel, a musician, in 1857, but was divorced in 1869. In the latter part of her life she taught elocution in New York City.

HERON'DAS, or **HERO'DAS** (Lat., from Gk. Ἡρώνδας, or Ἡρώδας). A Greek poet of the third century B.C., born, probably, in the island of Cos. Of his mimes or mimiambi, as they are sometimes called, nothing was known before 1890 except a few fragments. In that year, however, an Egyptian papyrus was found which contains seven comparatively complete poems and parts of two others. These are all written in the metre called the choliambus, or lame iambic trimeter. Unlike the works of the earlier iambographers, such as Archilochus and Hipponax, the poems of Herondas are not personal in their satire. They may be described as *genre* pieces descriptive of certain phases of life in the early Alexandrian time, and as such they are extremely interesting. The realism of these pictures is very striking. In them the Alexandrian age lives again in all its hurry and flurry, all its outward brilliancy and spiritual poverty. First publication by Kenyon, *Classical Texts from Papyri in the British Museum* (London, 1891). The latest edition is that of Crusius, *Untersuchungen zu den Mimiamben des Herondas* (Leipzig, 1892; 4th ed., 1904).

HEROPH'ILUS (Lat., from Gk. Ἡρόφιλος (c.300 B.C.). A famous surgeon of antiquity, born at Chalcedon in Bithynia. He studied medicine under Praxagoras, one of the followers of Hippocrates, and afterwards went to Alexandria in Egypt, where he became famous, and was one of the founders of the medical school in that city. His followers later spread to Pergamum, Laodicea, and elsewhere. Herophilus's greatest services were performed in the field of anatomy. He discovered the nerves and made important observations in connection with the eye. Several names which he gave to different parts of the body are still in use, one such, *tocular Herophili*, recording his own name. He is said to have practiced vivisection upon condemned criminals. His writings were numerous, but we have only fragments thereof.

HERO'S FOUNTAIN (named from its inventor, Hero of Alexandria). A pneumatic apparatus, in which a vertical jet of water is produced by the pressure of condensed air. A simple form of the apparatus constructed of glass tubes is shown in the annexed figure. The column of water in the left-hand tube compresses the air in the lower vessel; this causes an increase of pressure on the surface of the water in the upper cistern, and causes it to gush out at the jet.


HERO'S FOUNTAIN.

HEROS'TRATUS (Lat., from Gk. Ἡρόστρατος). An Ephesian, who, from a desire for future fame, set fire, in B.C. 356, on the very night on which Alexander the Great was born, to the magnificent Temple of Diana at Ephesus; only the walls and a few columns were left standing. Herostratus expiated the deed by a painful death, and the Ephesians passed a decree that his name should never be mentioned. It was revealed by Theopompus.

HER'PES (Lat., from Gk. ἕρπης, *herpês*, from ἕρπειν, *herpein*, Lat. *serpere*, Skt. *sarp*, to creep). A cutaneous eruption, characterized by spreading or creeping from place to place. The term was formerly applied to several different diseases, including eczema, psoriasis, lichen, and seborrhœa, as well as zona, to which it properly belongs. Zona, or herpes zoster, is a cutaneous disease of trophic origin, occurring as a sequence of various lesions of the nervous system; it is a dermatosis of nervous origin—a fact established by pathologists. The disease is of an acute, inflammatory nature, characterized by a set of vesicles as large as a split pea, occurring in clusters and following the course of a peripheral nerve. The course of the affection is from ten to fourteen days in each locality to which it spreads, each irregular cluster of vesicles going through the process of increase, maturation, and decline, each vesicle drying into a scab. The inflamed areas are exquisitely tender to the touch, sometimes itching at the same time. Soothing and cooling applications should be made, avoiding ointments whose base is grease. Galvanism is of benefit. Appropriate internal treatment for the nerve condition must be employed. Herpes zoster is popularly called 'shingles.'

HER'PETOL'OGY (from Gk. ἑρπετόν, *herpeton*, reptile, from ἕρπειν, *herpein*, to creep + -λογία, *-logia*, account, from λέγειν, *legein*, to say). That branch of natural history which treats of reptiles and formerly included the amphibia. Now, however, the term is restricted to the Reptilia proper, which includes lizards, snakes, turtles, crocodiles, alligators, and various extinct aquatic and terrestrial reptiles. The first attempt at a systematic arrangement of reptiles was made by Ray (1693), but he did not clearly comprehend their relationships, nor did he give the group a name. Linnæus (1735-68) classed tortoises, lizards, and serpents as amphibia, and recognized two sub-groups, (1) those with and (2) those without feet. He included in this class those forms which we to-day call amphibia, and later he added branchiostegous fishes. Of course, such an arbitrary classification, without any morphological foundation, was soon replaced by others. Linnæus recognized 213 species and 10 genera. Cuvier (1817-29) practically adopted the classification of Brongniart (1799), in which four orders were recognized: (1) Chelonia; (2) Sauria (lizards and crocodiles); (3) Ophidia (serpents and provisionally the cæcilians); and (4) Batrachia, the latter corresponding to our present Amphibia minus the cæcilians. The splendid additions to our knowledge of their anatomical structure, made by such men as Johannes Müller in Germany, Owen and Huxley in England, and Cope in America, and an increased knowledge of the embryological development of some puzzling forms, has greatly added to the accuracy of our classification both of the Reptilia and the Amphibia. The light which has been shed on the relationship of the groups by paleontological researches of the past century particularly has also been of inestimable value in the establishment of our present classification, for which see REPTILE.

HER'PETON (Gk. ἑρπετόν, reptile). An extremely rare snake of Southeastern Asia. It belongs to a family (Homàlopsidæ) of colubrine viviparous water-snakes, which prey upon fish and crustaceans, and often moor themselves by curling the prehensile tail about some waterside branch or root. This species (*Herpeton tentaculatum*) is peculiar in having two forward-pointing appendages covered with scales on the snout, supposed to be organs of touch. Compare LANGAHA.

HERRERA, ăr-rā'rȧ, FERNANDO DE (1534-97). A Spanish poet, born at Seville, the head of the so-called Seville school of lyric poetry in the sixteenth century. When advanced in life he took orders. He was master of the Greek, Roman, and Italian literatures, and was a man of prodigious learning. As a poet he ranked so high in the opinion of his contemporaries that they bestowed upon him the appellation of the 'divine.' Like his acknowledged master, Garcilaso de la Vega, he sings chiefly in the foreign Italian strains, and is particularly successful in the *canción* and the *soneto*. His masterpiece is the *canción* (or ode) *Por la vitoria de Lepanto.* Many of his erotic poems are remarkable for tender feeling, and his odes frequently display a lofty enthusiasm; but the expression is sometimes cast in too classical a mold, and consequently wears a certain air of artificiality. Herrera himself prepared for publication a volume of his verse, *Algunas obras* (Seville, 1582), to which additions were made in an edition by Pacheco (1619). The poems are to be found also in Ramón Fernandez. *Poesías castellanas* (1808), and in the *Biblioteca de autores españoles*, xxxii. (Madrid, 1872); selections in Ford, *A Spanish Anthology* (New York, 1901). His chief historical work is the *Relación de la guerra de Chipre y batalla de Lepanto* (1572), and he translated from the Latin of Stapleton a life of Sir Thomas More. In 1580 he published an annotated edition of the poems of Garcilaso. Consult: *Fernando de Herrera, Controversia sobre anotaciones á las obras de Garcilaso de la Vega: Poesías inéditas* (Seville, 1870); Morel-Fatio, *L'hymne sur Lépante* (Paris, 1893); Lasso de la Vega, *Historia de la escuela poética sevillana* (Madrid, 1876); Bourciez, in the *Annales de la Faculté des lettres de Bordeaux* (Bordeaux, 1891).

HERRERA, FRANCISCO DE (1576-1656), called El Viejo (the elder). A Spanish painter of the school of Seville. He was the first to emancipate himself from the Italian manner then dominant in Spain, and to assume the vigorous naturalistic style afterwards adopted by Velazquez (q.v.). He may therefore be regarded as the founder of the new national school of Spain. Herrera was born at Seville in 1576, and studied painting with Luis Fernandez, who painted in the Italian manner. He soon emancipated himself from this master, and founded a school of his own; but his unbearable temper drove away his pupils, among whom was Velazquez, and even his own sons. A carver in bronze, Herrera was accused of counterfeiting money, and in order to avoid arrest he took sanctuary in the Jesuit College at Seville. While there he painted the "Triumph of Saint Hermengild," now in the Museum of Seville—a picture of such merit that when it was seen by Philip IV. on his visit to the city he pardoned the artist. After his release Herrera became more unbearable than ever. His wife left him; his elder son, called El Rubio, died of consumption; and his younger, Herrera el Mozo, robbing his father of his money, fled to Italy. In 1650 the father went to Madrid, where he died in 1656.

His subjects are generally sombre and tragic, and are mostly of a religious nature, although he sometimes painted genre. They contain all the qualities of a great artist; a design grandiose but correct and true to nature, especially in the nudes; a harmonious color, laid on in great masses. He painted both in oils and al fresco, but most of his fresco-work has disappeared. His principal works are at Seville. Among them are the "Last Judgment," in the Church of San Bernardo; four great pictures in the archiepiscopal palace, representing the "Fall of Manna," "Moses Smiting Water from the Rocks," the "Marriage at Cana," and the "Miracle of the Loaves and Fishes;" "Saint Peter," in the Cathedral; and "Saint Basil," in the Museum; "Saint Augustus and Saint Jerome," in the Montpensier Collection, Seville. The Louvre has two excellent examples, "Saint Basil Dictating His Doctrine," and the "Israelites Gathering Manna in the Desert;" the Museum of Dresden, a "Saint Matthew." The frescoes with which he ornamented the façade of the convent of La Merced, at Seville, have perished, as have also those at Madrid. Luckily the artist himself etched a number of the latter, showing great skill in this branch of art, as is further evident from his print, "Saint Peter."

His son, FRANCISCO HERRERA (1622-85), called El Mozo (the younger), after he had fled to Italy, painted pictures of various subjects, especially of fish, the latter with such success that he was called "Il Spagnuolo degli Pesci." In 1656, after his father's death, he returned to Seville. In 1660 he was one of the founders of the academy there, but on account of his jealousy of Murillo (q.v.), who was made president, while Herrera was vice-president, he went to Madrid in 1661. He became Court painter to Philip IV., and master of the royal works under Charles II. In this office he figured as an architect, assisting in the renovation of the Cathedral of Saragossa. His work as a painter was brilliant, but manneristic. His works include the "Four Doctors of the Church Adoring the Host," Museum of Seville; the "Immaculate Conception," and "Saint Hermengild," now in the Prado Museum; and the frescoes of the Chapel of Our Lady of Atocha, "The Ascension of Mary," his chief work. Consult: Bermudes, *Diccionario de los mas illustros profesores* (Madrid, 1800); Stirling Maxwell, *Annals of the Artists of Spain* (London, 1848).

HERRERA, José Joaquin de (1792-1854). A Mexican general, born at Jalapa. He rebelled with Iturbide (1821), but opposed him when he was made Emperor. Herrera was Minister of War; President of the Supreme Court; was President for three months and a half in 1845; was Santa Anna's lieutenant in the war with the United States of America; and was President again (1848-51).

HERRESHOFF, hĕr′rĕs-hŏf, John B. (1841—). An American naval architect, born in Bristol, R. I., and a brother of Nathaniel Herreshoff. He is a descendant of John Brown who headed the attack on the *Gaspée*, and early showed both inventive ability and love of the sea. Although he became blind at fifteen, he built up and managed the business of the Herreshoff Manufacturing Company, which succeeded Edward Burgess as designer of the defenders of the *America* cup, and many stories are told of his wonderful grasp of detail and of his perfect freedom of movement in shop and on board ship.

HERRESHOFF, Nathaniel Greene (1848—). An American naval architect, born at Bristol, R. I. He was educated at the Massachusetts Institute of Technology, and made a special technical study of engineering in the Corliss Works at Providence, R. I., where he assisted in the construction of the large engine which furnished motive power for all machinery at the Philadelphia Exposition of 1876. He became superintendent of the Herreshoff Manufacturing Company, boat-builders, at Bristol, R. I., and designed numerous torpedo-boats and yachts. Among the high-speed torpedo-boats designed by him for the United States Government were the *Lightning* and the *Cushing*. His reputation in connection with racing yachts dates mainly from the triumphs of the *Gloriana* in 1891. The success of the four craft built for contests in defense of the famous *America's* cup, the *Vigilant*, *Defender*, *Columbia*, and *Reliance*, placed him among the foremost of his profession. He introduced many innovations in the architecture of racing yachts, and invented a coil boiler for use on steam vessels built by the Herreshoff Company.

HER′RICK, Edward Claudius (1811-62). An American meteorologist, born in New Haven, Conn. He was librarian at Yale College from 1843 to 1858, and treasurer from 1852 until his death. He made noteworthy contributions to the knowledge of meteorology, meteoric showers, the Aurora Borealis, and the zodiacal light. He was likewise an entomologist of distinction, and devoted nine years to the study of the Hessian fly and its parasites. His reputation is one of the treasures of Yale College.

HERRICK, Robert (1591-1674). An English poet, born in London. He was educated at Cambridge, and in 1629 was presented to the Vicarage of Dean Prior, Devonshire. Ejected from his parish by the Long Parliament in 1647, he repaired to London. In 1648 appeared a collection of his poems, in two parts, bound together, bearing the titles *Hesperides* and *Noble Numbers*. Some of these poems, however, had been finding their way into print ever since 1635. On the restoration of Charles II. he was reinstated in his old living, where he died. His poems, which are mostly lyrical, are graceful and melodious, and show much fine fancy. They vary in subject from amatory verses, pagan in tone, to pieces of deep religious feeling. Such songs as "Cherry Ripe" and "Gather Ye Rosebuds While Ye May," are universally known. They and scores of others are exquisite in sentiment and admirable in form. Though duly appreciated in his own time, Herrick was neglected for more than a hundred years after his death. Rediscovered in the nineteenth century, he has steadily grown in favor. There are editions of his poems by Hazlitt (London, 1869), Grosart (ib., 1876), Palgrave (selections, ib., 1877), Pollard, with critical essay by Swinburne (ib., 1891), and an essay by Gosse in *Seventeenth Century Studies* (ib., 1883).

HERRIG, hĕr′rĭk, Hans (1845-92). A German poet and dramatist, born in Brunswick. He studied law at Berlin and Göttingen, and at first was employed in the Berlin city court, but after 1872 devoted himself entirely to literature, was editor of the *Deutsches Tageblatt* from 1881 to 1888, and wrote many plays that attained wide popularity. His *Festspiel*, written for the Luther Jubilee in 1883, was especially successful. His dramas, which are more distinguished for elegance and force of diction than for positive dramatic skill, comprise: *Alexander der Grosse* (1872); *Kaiser Friedrich der Rotbart* (1873); *Jerusalem* (1874); *Der Kurprinz* (1876); *Konradin* (1881); *Harald der Wiking* (1881), which was set to music by Andreas Hallén; *Drei Operndichtungen* (1881); *Nero* (1883); *Columbus* (1887); and *Christnacht* (1887). His other writings are: *Die Schweine* (1876); *Mären und Geschichten* (1879); *Der dicke König* (1885); *Die Meininger, ihre Gastspiele und deren Bedeutung für das deutsche Theater* (1879); *Luxustheater und Volksbühne* (1886); *Ueber christliche Volksschauspiele* (1891); and *Das Kaiserbuch* (1891).

HERRING (AS. *hæring*, OHG. *harinc*, Ger. *Hering*, herring, from AS. *here*, OHG. *hari*, *heri*, Ger. *Heer*, army; in allusion to the shoals in which the fish moves). A fish of the family Clupeidæ, belonging to the genus Clupea, very closely related to the shads and sardines. Herring are soft-rayed fishes, with a compressed body and rather large cycloid scales. The head is naked, and the caudal fin is forked. They occur in all the northern seas, and make periodic migrations from the deeper waters to the shore for the purposes of spawning. In the more northern regions this occurs during the spring and early summer; in the more southern regions, in July to December. The average yield of eggs is about 30,000 to the fish, with a maximum of about 55,000. They are laid in shallow waters and are slightly glutinous, sticking in clumps to rocks, etc., on the bottom. The young herring probably remain on the shallow spawning beds all the year. At this period of spawning they swim in great schools, and are taken in vast numbers for commercial purposes. The herring fisheries are very extensive both in Europe and America. The estimated annual catch is 3,000,000,000, weighing one-half that many pounds. They are largely smoked, salted, and canned. The young in certain regions are canned as sardines. Fresh herring are much used as bait for cod and other fishes taken by line. See Fisheries.

Herring live on minute crustaceans and larval forms of a great variety of animals, which they strain out of the water, and are themselves preyed upon to an enormous extent by cod, haddock, sharks, and other fishes, and by sea-birds.

The common herring (*Clupea harengus*) frequents both sides of the Atlantic southward to the thirty-seventh parallel. It attains a maximum length of about 17 inches, the usual average being about 12 inches. The California herring (*Clupea Pallasi*) strongly resembles the Atlantic one in form and habit, and is about equally abundant and an important food-fish. There are other less valuable species, belonging to this or a related genus. Thus the various species of alewife (q.v.) are known as 'herrings,' with distinguishing adjectives. The 'lake' or 'Michigan herring,' however, is an entirely unrelated form, being a salmonoid (see Cisco), although greatly resembling the common herring in form and general appearance. Consult, for an extensive natural history of the herring family, Goode, *Fishery Industries*, Section I. (Washington, 1884). See Plate of Herring and Shad.

HERRING, John Frederick (1795-1865). An English animal painter, born in Surrey. He was for many years a coachman, and during this time and afterwards devoted himself to painting pictures of horses. His racing and coaching pictures have often been lithographed. The "York Stage," the "Mail Coach," and the "Mail Change" are spirited representations of methods of traveling in the early days of the last century. He also did a series of portraits of the Derby and St. Leger winners. His genre picture, "A Frugal Meal," is in the National Gallery, London.

HERRING-GULL. See Gull.

HERRING-HOG. A porpoise; especially, in New England, the common small harbor porpoise, also called 'puffing pig.' See Porpoise.

HERRINGS, Battle of the. See Fastolf, Sir John.

HERR′MANN, Alexander (1844-96). An American prestidigitateur, born in Paris. After public performances in various European cities from 1856, he appeared in 1861 in the United States, and in the same year was naturalized. He traveled professionally all over the world, even to the Far East, the home of the sleight-of-hand art, where he was received with amazement. In 1874 he made his first transcontinental tour of the United States. As a master of pure sleight-of-hand, and as a performer who united the entertaining with the mystifying, he has perhaps never been surpassed.

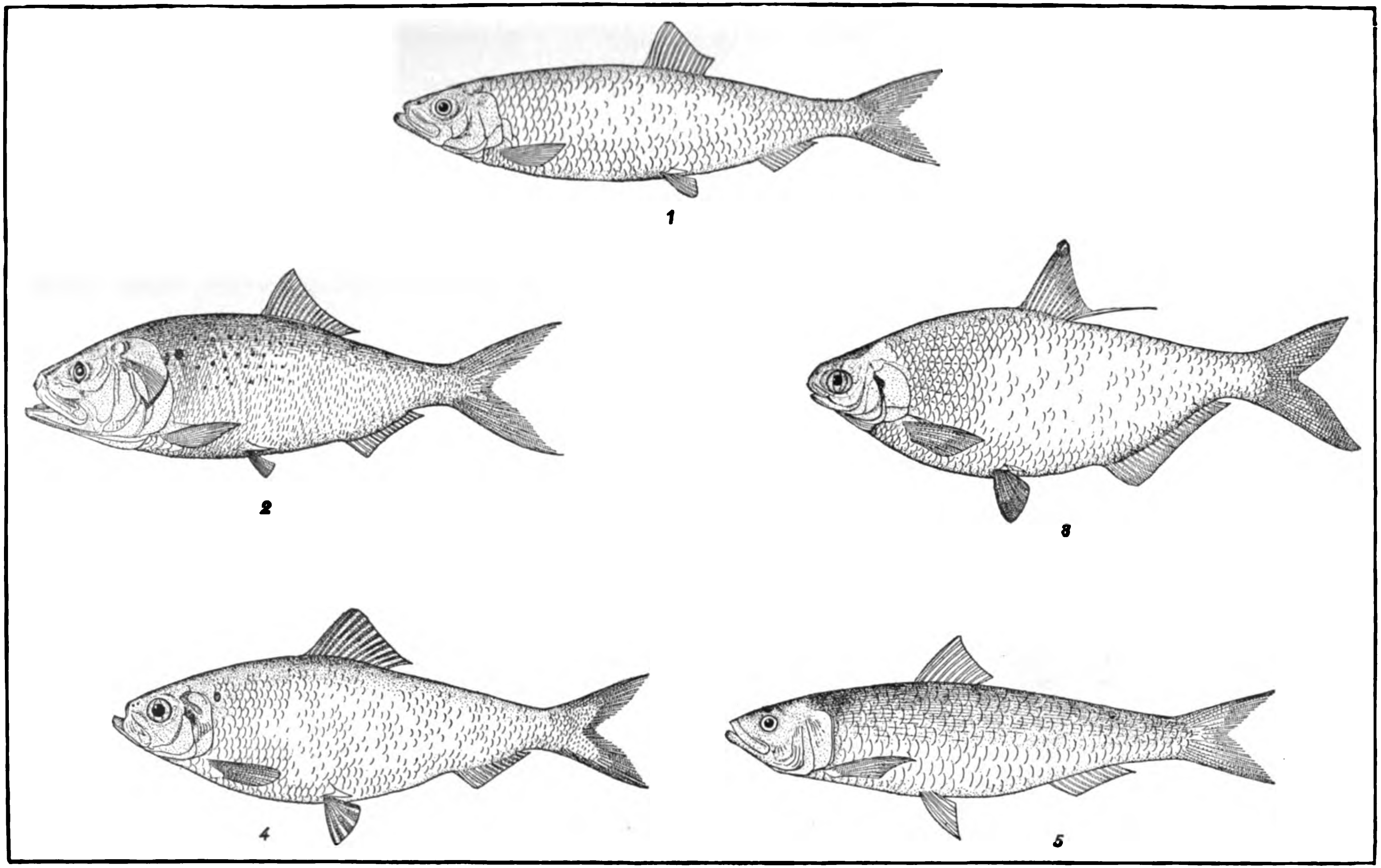
HERRMANN, hĕr′mȧn, or **HEERMANS**, hār′mȧns, or **HARMAN**, hạr′mȧn, Augustine (1605-86). An American colonist, active chiefly in the affairs of New Netherlands, and afterwards in those of Maryland. He was born in Prague, Bohemia, and after receiving an excellent training in modern languages and mercantile life, entered the service of the Dutch West India Company. It is said that he came to Virginia in 1629, and that he was the original founder of the tobacco trade of that colony. Having settled in New Amsterdam in 1643, he began to take an important share in the civic life of the Dutch settlements, and was of much service in regulating the relations of New Netherlands with Rhode Island and Maryland. Having been sent to Maryland in 1659 to uphold the rights of New Netherlands as against the claim of Lord Baltimore to the Delaware River, he presented the case of his colony with great force, and the State of Delaware is believed to have owed its existence to the arguments established on that occasion. He later obtained from Lord Baltimore a charter to found Cecil town and county in Maryland, and induced some New Amsterdam people to go there with him. Having made a valuable map of Maryland and Virginia, he received land grants amounting in all to 30,000 acres, with manorial privileges. He was given the title of Lord of Bohemia Manor, became a member of the Governor's Council, a justice of Baltimore County, and in 1678 was made a commissioner to treat with the Indians. His descendants were lords of Bohemia Manor until 1735.

HERRMANN, hĕr′mȧn, Ernst Adolf (1812-84). A German historian, born at Kämmerswalde. He studied at Dorpat, and at Berlin under Ranke, and then lived in Dorpat (1837-39) and in Dresden. In 1847 he became docent at Jena, then professor of history there, and afterwards (1857) at Marburg. His work was mostly on the history of Russia; especially important was his completion of Strahl's *Geschichte des russischen Staates* (1846-66). Among his other writings are: *Beiträge zur Geschichte des russischen Reichs* (1843); *Die österreichisch-preussische Allianz vom 7. Februar 1792 und die zweite Teilung Polens* (1861), which was an attack on Sybel; and *Peter der Grosse und der Zarewitsch Alexei* (1880).

HERRNHUT, hĕrn′ho͞ot. A small town in the Kingdom of Saxony, situated on the southern slope of the Hutberg, 11 miles from Zittau (Map: Germany, F 3). It is noted throughout Germany as the central seat of the Moravian Brotherhood. The town has manufactures of linen, furniture, etc., the products of Herrnhut being famous all over Germany. The community was founded in 1722 by a colony of persecuted Moravians, some of whom were descended from the old Bohemian and Moravian Brethren. In coming into Saxony they were sheltered and protected by the pious Count Zinzendorf, to whom Herrnhut belonged. Population, in 1900, 1242, including 830 Moravians.

HER′RON, Francis Jay (1837-1902). An American soldier. He was born in Pittsburg, Pa.; graduated at the Western University of Pennsylvania in 1853, and after 1856 engaged in business in Iowa. He served in Iowa volunteer regiments in the Civil War, becoming brigadier-general of volunteers in July, 1862, for a time commanding the Army of the Frontier, and being made major-general of volunteers in November, 1862. At Vicksburg he commanded the left wing

HERRING AND SHAD



1. COMMON HERRING (Clupea harengus).
2. MENHADEN (Brevoortia tyrannus).
3. MUD or HICKORY SHAD (Dorosoma cepedianum).
4. ALEWIFE (Pomolobus æstivalis).
5. PILCHARD (Clupea pilchardus).

of the investing forces, and at the close of the war received the surrender of the Confederate forces west of the Mississippi. He resigned in 1865, entered on the practice of law in New Orleans, was United States marshal of the District of Louisiana from 1867 to 1869, and was Secretary of State of Louisiana in 1872-73. He subsequently practiced law in New York City.

HERRON, George Davis (1862—). An American clergyman and writer, born in Montezuma, Md., and educated at Ripon College, Wisconsin. He held Congregational pastorates at Lake City, Minn., and Burlington, Iowa, and in 1893 became professor of applied Christianity in Iowa College. Opposition to his teachings led him to resign in 1900, and he then initiated a social crusade in Chicago and New York, founded the *Social Crusader,* and lectured upon "The Economics of the Kingdom of Heaven" and similar topics, chiefly advocating a transformation of the present economic order into conformity with the Christian principle of the brotherhood of men. He aroused great controversy throughout religious circles generally in 1901 by his separation from his wife, his second marriage, and his published theories regarding a free marriage relation. At a meeting of the Iowa Congregational Council he was deposed from membership. His principal writings are: *The Larger Christ* (1891); *The Call of the Cross* (1892); *A Plea for the Gospel* (1892); *The New Redemption* (1893); *The Christian Society* (1894); *The Christian State* (1895); *Between Cæsar and Jesus* (1899).

HERSCHEL, hĕr′shel, Caroline Lucretia (1750-1848). A German-English astronomer, sister of Sir William Herschel. She lived in Hanover till 1772, when she came to England to live with her brother at Bath. When he turned astronomer, she became his constant helper, and on his being appointed private astronomer to George III. acted as his assistant in the famous observatory at Slough, receiving a small salary from the King. She found time for a series of independent observations with a small Newtonian telescope made for her by her brother. Her special occupation was to scan the heavens for comets, seven of which she discovered, in regard to five of which she has the credit of priority of discovery; and several remarkable nebulæ and clusters of stars included in her brother's catalogues were described from her original observations. In 1798 she published *A Catalogue of Stars taken from Mr. Flamsteed's Observations,* etc. This work was published at the expense of the Royal Society, and contained 561 stars omitted in the British catalogue. She lived with her brother during the whole of his career, and on his death, in 1822, returned to her native country. In 1828 the Royal Society conferred on her their gold medal for completing the catalogue of nebulæ and clusters of stars observed by her brother. She was afterwards chosen an honorary member of the Royal Society. Consult: Mary C. Herschel, *Memoir and Correspondence of Caroline Herschel* (London, 1876): Clerke, *The Herschels and Modern Astronomy* (London, 1895).

HERSCHEL, Sir John Frederick William (1792-1871). An eminent English astronomer, the only son of the astronomer William Herschel. He was born at Slough, near Windsor, March 7, 1792, and was educated at Saint John's College, Cambridge. His first publication was *A Collection of Examples of the Application of the Calculus of Finite Differences* (1820). In 1822 he applied himself especially to astronomy, using his father's methods and instruments in observing the heavens. For a time he worked with Sir James South in reëxamining the nebulæ and clusters of stars described in his father's catalogues. The results of the reëxamination were given in 1833 to the Royal Society in the form of a catalogue. The catalogue contained observations on 525 nebulæ and clusters of stars not noticed by his father, and on a great number of double stars—in all, between 3000 and 4000. His "Treatise on Sound" appeared in the *Encyclopædia Metropolitana* in 1830, and his "Treatise on the Theory of Light" in the same work in 1831, in which year also appeared in Lardner's *Cyclopædia* his "Preliminary Discourse on the Study of Natural Philosophy." In 1836 appeared his "Treatise on Astronomy," in Lardner's *Cyclopædia.* At this time Herschel was at the Cape of Good Hope, where he arrived in January, 1834, with the intention of completing the survey of the sidereal heavens by examining the Southern Hemisphere as he had done the Northern. Here he established his observatory at a place called Feldhausen, six miles from Table Bay. On March 5, 1834, he commenced his observations, which were embodied in his *Results of Astronomical Observations Made During 1834-38 at the Cape of Good Hope; Being a Completion of a Telescopic Survey of the Whole Surface of the Visible Heavens, Commenced in 1825* (1847). On his return to England, in 1838, honors were showered on him. He got the Royal Society's gold medal in 1826; he now was made a D.C.L. of Oxford, was created a baronet, succeeded the Duke of Sussex as president of the Royal Society, and in 1848 he became president of the Royal Astronomical Society. In 1849 he published his *Outlines of Astronomy.* In 1850 he was appointed master of the mint. This office, on account of ill health, he resigned in 1855. Consult Clerke, *The Herschels and Modern Astronomy* (London, 1895). For a list of his contributions, consult the Royal Society's great catalogue.

HERSCHEL, Sir William (1738-1822). An eminent German-English astronomer, born at Hanover, Germany, November 15, 1738. The son of a musician, he was educated specially as a professional musician. In 1757 he went to England, where he became a teacher of music in the town of Leeds, from which he went to Halifax as organist, and subsequently (1766) in the same capacity to Bath. Here he would seem to have first turned his attention to astronomy. Wanting a telescope, and unable to afford a reflector, he made one for himself—a Newtonian, of five feet focal length—and with this applied himself to study the heavens. In 1781 he made his first discovery, a new planet, which at first he took for a comet. It was detected by an exhaustive process of surveying the heavens, which Herschel was the first to follow, taking the stars in regular series, and examining them in all their groups through the same instrument. The result of his discovery was his appointment to be private astronomer to George III., with a salary of £200 a year. He then went to live at Slough, near Windsor, where, assisted by his sister Caroline (q.v.), he continued his researches. He was knighted by George III., and made a D.C.L. by the University of Oxford; he became rich, partly through his wife's jointure, and partly through selling mirrors for reflecting telescopes. He died at Slough, August 25, 1822.

Herschel contributed sixty-nine papers to the *Philosophical Transactions* between the years 1780 and 1815, and to the first volume of *Memoirs of the Astronomical Society* he contributed a paper, "On the Places of 145 New Double Stars." He greatly added to our knowledge of the solar system; he discovered Uranus and six satellites, and two satellites of Saturn. Besides this, he determined the period of rotation of Saturn and that of Venus, the existence of the motions of binary stars, the first revelation of systems besides our own. He threw new light on the Milky Way and the constitution of nebulæ, and, in fact, was the first to give the human mind any conception of the immensity of the universe. When in 1780 he began his researches, less than 150 nebulæ were known, but as a result of his observations the number increased to nearly 2500, and through him the nebulæ acquired a new importance in the universe. He advanced, in the earlier period of his researches, the theory that the nebulæ were clusters of stars, the component stars being too faint, on account of their immense distance, to be seen separately. For the explanation of some of the nebulæ, among them the nebulæ of Orion, he, however, reverted to the old theory, that the nebulæ were masses composed of a shining fluid of a nature unknown to us. His catalogue of double stars, nebulæ, etc., and tables of the comparative brightness of stars, and his researches in regard to light and heat, would of themselves entitle him to the first rank as an astronomer and physicist. He erected a monster reflecting telescope, as it was then considered, of 40 feet focal length and 4-foot apertures. It was begun in 1785 and finished in 1789, on August 28th of which year he, by means of it, detected the sixth satellite of Saturn, and on the 17th of September a seventh. Consult Holden, *Sir William Herschel: His Life and Works* (New York, 1881).

HERSCHELL, Farrer, Lord (1837-99). An English lawyer and politician. After completing his education at Bonn and University College, London, he entered at the bar in 1860, and in twelve years was Queen's counsel. He was recorder of Carlisle in 1873-80, member of Parliament for Durham (1874-85), Solicitor-General under Gladstone (1880), and was knighted the same year. He was raised to the peerage six years later and made Lord Chancellor. He was president of the royal commission to inquire into the proceedings of the Metropolitan Board of Works (1888). and once more Lord Chancellor in 1892. He died in Washington, D. C., while serving as chairman of the Anglo-American Joint High Commission.

HERSENT, âr′säɴ′, Louis (1777-1860). A French historical painter, born in Paris. He studied under Regnault and David, and won the Prix de Rome in 1797. In 1817 he attracted some attention by his "Daphnis et Chloë." His best picture, "L'abdication de Gustave Wasa" (1819), painted shortly afterwards, was destroyed. Several of his works are at Versailles. After 1824 he painted principally portraits, such as those of the Duc d'Angoulême, Louis Philippe, and Queen Amélie. Hersent is an excellent representative of the classic school of David.

HERSFELD, hĕrs′fĕlt. An ancient town in the Prussian Province of Hesse-Nassau, situated on the Fulda, 23 miles by rail from Fulda (Map: Prussia, C 3). It still retains a portion of its old fortifications, and contains an old church dating from the thirteenth century; the ruins of a collegiate church, originally built in the eleventh and twelfth centuries, and destroyed by the French in 1761; the remains of the Benedictine Abbey of Hersfeld; and an old Rathaus. There are manufactures of cloth, cotton goods, and leather. The Abbey of Hersfeld, founded in 770, by Lullus, Archbishop of Mainz, enjoyed great renown through the Middle Ages. Population, in 1890, 6758; in 1900, 7908.

HERSTAL, hĕr′stål, or **HERISTALL**. A manufacturing and mining place in the Province of Liège, Belgium, extending along the left bank of the Meuse for about three miles immediately below the city of Liège, of which it may be considered a suburb (Map: Belgium, D 4). It has extensive metal-works and coal-mines in the vicinity; its population is made up chiefly of the workingmen employed in the mills and mines. Some ruins still exist of the Castle of Herstal, the birthplace of Pepin le Gros (father of Charles Martel, and great-grandfather of Charlemagne), from which he has his title of Pepin of Herstal. Population, in 1890, 13,877; in 1900, 18,195.

HERTEL, hĕr′tel, Albert (1843—). A German painter, born in Berlin. He studied at the Berlin Academy, where he became professor in 1875, and of which he was elected a member in 1901. His landscapes are notable for style and fine coloring; among them are: "The Via Flaminia" (1872); "Olive Harvest in Capri" (1872); "After the Storm on the Coast of Genoa" (1878) and "Northern Coast Scene with Fishermen Returning" (1883), both in the National Gallery, Berlin; "Road Between Rapallo and Santa Margherita" (1892, bought by Emperor William II.); and "View in the Roman Campagna" (1896). He also painted decorative subjects.

HERTEL DE ROUVILLE, âr′tĕl′ de rōō′vēl′, Francis (1643-1722). A Canadian soldier, born in Three Rivers, Maurice County, Quebec. As a woodsman and Indian fighter he was widely known for valor and resourcefulness. Captured by the Iroquois in 1681, he bore various tortures with such fortitude that, instead of being put to death, he was adopted by the tribe. After a time, however, he escaped from the Indians and rejoined his comrades. Acting as one of Frontenac's lieutenants in 1690, he ravaged settlements in the lower part of Maine, escaped by adroitness from the greatly superior force of the English colonists, and united with the band attacking Falmouth, now Portland, where his strategy aided in the speedy capture of the village. Louis XIV. promised to reward him with letters of nobility, which he did not receive, however, until twenty-six years afterwards.

HER′TER, Albert (1871—). An American figure painter, born in New York City. He studied at the Art Students' League there and at Corman's, and under J. P. Laurens in Paris. Afterwards he traveled in Japan, and was influenced by Japanese art. His work has fine decorative qualities, and his color is rich and well handled. He received honorable mention at the Salon of 1890, and a bronze medal at the Paris Exposition of 1900.

HERTER, Ernst Gustav (1846—). A German sculptor, born in Berlin. He studied at the Berlin Academy, and as a pupil of August Fischer, Bläser, and Albert Wolff, was elected a member of the Academy in 1885, and obtained a professorship there in 1889. His work is careful in execution, but often formal and undistinctive. Among examples of it may be cited such imitations of the antique as "Alexander the Great Studying" (1876) and "The Wounded Achilles" (1879), both in the National Gallery at Berlin; "Moses Breaking the Tables of the Law" (1881); a statue of Helmholtz in the grounds of the Berlin University (1899); a fountain commemorative of Heine in New York; a statue of William I. at Holtenau (1900); and various decorations for public structures.

HERT′FORD. The capital of Hertfordshire, England, a municipal borough and market-town on the Lea, 26 miles north of London by rail (Map: England, F 5). The fourteenth-century Church of All Saints, destroyed by fire in 1891, has been replaced by a fine Perpendicular edifice; the shire hall and corn exchange are the chief of several important public buildings. The town has a preparatory branch of Christ's Hospital, a grammar school, and several charity schools. It owns the water-supply, markets, and a free public library, and school of art. Its industries and trade are chiefly agricultural. The old castle, of which traces remain, was built about 905. The present castle is of the time of James I., and was the temporary home of Haileybury College when its present buildings were being erected, two miles to the southeast. Domesday Book records Hertford as a borough, and it received its charter in 1544 from Queen Mary. Population, in 1891, 9000; in 1901, 9300.

HERTFORD, William Seymour, First Marquis of. See Seymour.

HERT′FORDSHIRE, or **HERTS.** An inland county of England, bounded on the east by Essex, on the south by Middlesex, on the west by Buckingham and Bedford, and on the north by Cambridge (Map: England, F 5). Area, 635 square miles. Population, in 1891, 220,162; in 1901, 250,350. The surface presents a pleasing succession of finely wooded hill and fertile valley. The chief elevations are those of the chalk downs, a branch of the Chiltern Hills, which skirt the north of the county. The principal rivers are the Lee and the Colne, both affluents of the Thames. Agriculture is the chief industry, over three-fourths of the total area being cultivated. Immense quantities of hay and straw are sold, and throughout the county there are numerous gardens and orchards, the fruit of which is sent to the London market. Great quantities of malt are made in the county. Ware is the chief seat of the malting trade in the kingdom. Paper and straw-plait are extensively manufactured in the west and south. Capital, Hertford.

HERTHA, hĕr′tȧ, **HER′THUS**, or **ÆR′THA** (Goth. *airþa*, OHG. *erda*, Ger. *Erde*, AS. *eorþe*, Eng. *earth*; connected with OHG. *erō*, earth, Gk. *ἔραζε*, *eraze*, on the earth, and perhaps with Lat. *arvum*, field, *arare*, Gk. *ἀροῦν*, *aroun*, OChurch Slav. *orati*, Goth. *arjan*, OHG. *erian*, to plow). A deity of the ancient Germans. Tacitus states that she was worshiped with great solemnity by the Suevi, and that her temple stood in an island of the ocean, where her service was performed by a single priest. On great occasions which were regulated by this priest, the covered chariot of the goddess was drawn forth from the sanctuary by sacred cows and led in triumph throughout the country. Those districts through which the chariot passed were held to be peculiarly favored, peace was always proclaimed, and the occasion celebrated by universal merrymaking, until the priest declared that it was the will of the goddess to return to her shrine. Her image was then washed in a sacred spring, and all who witnessed the ceremony of the ablution were drowned. The island of Rügen was long thought to be identical with the sacred island of Hertha, but the same honor has been claimed for Helgoland and Zetland.

HERTOGENBOSCH, hĕr-tō′gen-bŏs′, or **HERZOGENBOSCH.** The capital of the Dutch Province of North Brabant. See Bois-le-Duc.

HERTWIG, hĕrt′vĭk, Oskar (1849—). A German embryologist, born at Friedberg. He studied medicine in Jena under Haeckel and Gegenbaur, and at Zurich and Bonn. In 1878 he was made professor at Jena, and in 1888 professor of anatomy in Berlin. He studied with Haeckel and with his brother, Richard Hertwig, at Lesina on the Adriatic in 1871, in Corsica and Villefranche in 1875, and afterwards with his brother in Messina and Naples. He is one of the most influential embryologists of his time. The following are the most important of his publications: *Beiträge zur Kenntnis der Bildung, Befruchtung und Theilung des tierischen Eies* (1876), an epoch-making work, in that in it is established the fact that fertilization consists of the conjugation of the two equivalent sexual cells; *Studien zur Blättertheorie* (with R. Hertwig, 1879-83); *Die Cölomtheorie; Versuch einer Erklärung des mittleren Keimblattes* (with R. Hertwig, 1881); *Entwicklung des mittleren Keimblattes der Wirbelthiere* (with R. Hertwig, 1883); *Das Problem der Befruchtung und der Isotropie des Eies, eine Theorie der Vererbung* (1884); *Vergleich der Ei- und Samenbildung bei Nematoden* (1890); *Lehrbuch der Entwicklungsgeschichte des Menschen und der Wirbelthiere* (1886), translated into English by Edward L. Mark as *Textbook of Embryology* (1892); *Die Zelle und die Gewebe* (1892 and 1898); *Urmund und Spina Bifida* (1892); *Ueber den Werth der ersten Furchungszellen für die Organbildung des Embryos* (1893); and *Zeit und Streitfragen der Biologie* (1894).

HERTWIG, Richard (1850—). A German zoölogist, born at Friedberg. He studied medicine in Jena under Haeckel and Gegenbaur, and also in Zurich and Bonn. In 1874 he became privat-docent, and in 1881 professor extraordinarius in Jena. He was made professor of zoölogy in 1881 at Königsberg, and in 1885 at Munich. He studied with his brother, Oskar Hertwig, and with Haeckel on the Adriatic at Lesina in 1871 and in Corsica and Villefranche in 1875, and later with his brother in Messina and Naples. His publications include: *Zur Histologie der Radiolarien* (1876); *Studien zur Blätter-*

theorie (with O. Hertwig, 1879-83); *Die Cölomtheorie, Versuch einer Erklärung des mittleren Keimblattes* (with O. Hertwig, 1881); *Die Aktinien der Challenger Expedition* (1882); *Ueber Kernstruktur und ihre Bedeutung für Zelltheilung und Befruchtung* (1888); *Ueber die Konjugation der Infusorien* (1889); *Ueber Befruchtung und Conjugation* (1892); *Lehrbuch der Zoologie* (1893); *Kerntheilung, Richtungskörperbildung und Befruchtung von Actinosphærium Eichhorni* (1898).

HERTZ, hĕrts, Heinrich (1857-94). A German physicist, born at Hamburg. He studied at first to become a civil engineer, but forsook this profession for the study of mathematics and pure science, which he pursued at Munich and Berlin, becoming Helmholtz's assistant at the latter university in 1880. In 1883 Hertz became privat-docent at Kiel, and two years later was called to the Polytechnic Institute at Karlsruhe as professor of physics. His earlier experiments with electro-magnetic waves were performed during his occupancy of this professorship, and made for Hertz such a reputation that he was in 1889 called to the important chair of physics at Bonn, previously occupied by Clausius. To Hertz is due the realization and detection of the electro-magnetic waves which Maxwell had discovered in his theoretical consideration of the nature of electricity. Hertz found that waves produced by the spark of an electrical machine could be received by a circular loop of wire, and was able to show the reflection, refraction, diffraction, and polarization of the waves. The first paper describing these wonderful discoveries was published in 1887 and the series continued for several years in *Wiedermann's Annalen.* In 1890 was published *Ueber die Beziehungen zwischen Licht und Electricität,* while his *Gesammelte Werke* were published in Leipzig the year after his death. English translations entitled *Electric Waves,* by D. E. Jones, with a preface by Lord Kelvin (1893), and *Miscellaneous Papers,* by D. E. Jones and G. A. Schott, with an introduction by Philipp Lenard (1896), have been published. Consult "Biographical Sketch," in *Popular Science Monthly* (New York, 1894), reprinted in *Smithsonian Report* (Washington, 1894).

HERTZ, Henrik (1798-1870). A Danish dramatist, born in Copenhagen. He continued the literary impulse of the generation of Oehlenschläger, Heilberg, and, more immediately, Baggesen. A Jew, early orphaned, afterwards Christianized and brought up in a literary atmosphere for the law, he abandoned this gradually for the drama (*Buchardt and His Family,* 1827; *Love and Policy; Cupid's Strokes of Genius,* 1830), and for satiric criticism in Baggesen's vein (*Letters of a Ghost; Poetic Epistles from Paradise,* 1830), with cutting attacks on the early work of Hans Andersen, that created a deep impression. Continuing dramatic work, Hertz fell into the romantic movement in *Svend Dyring's House* (1838), and gained cosmopolitan recognition for *King René's Daughter* (1845), a charming bit of Provençal chivalric romance from the last "Court of Love," beautiful even in its translations (Englished by Theodore Martin). A tragedy, *Ninon* (1848), is also noteworthy. He was also an editor and poet. His *Dramas* are collected in eighteen volumes (1854-73), his *Poems* in four (1851-62).

HERTZ, Martin Julius (1818-95). A German classical scholar. He was born at Hamburg, and after studying at Berlin and Bonn, was appointed professor ordinary of classical philology at Greifswald in 1855. He was called to a similar chair at Breslau in 1862, and remained there until 1893, when he retired. He is celebrated chiefly for his text edition (2 vols., 1853; 2d ed. 1886), and critical edition (2 vols., 1883-85) of Aulus Gellius. Of his other works, the best known are his *Karl Lachmann. Eine Biographie* (1851); his critical edition of Priscian's *Institutiones Grammaticæ* in Keil's *Grammatici Latini,* vols. ii. and iii. (1855-59); and his recensions of Livy (4 vols., 1857-63) and of Horace (1892).

HERTZ, Wilhelm (1835-1902). A German poet, born in Stuttgart. His university studies were prosecuted at Tübingen, and during residence there he was encouraged in Germanic researches by Uhland, and wrote the major portion of his *Gedichte* (1859). In 1858 he became a member of the literary group at Munich that numbered Lingg, Heyse, and Geibel, to whose *Dichterbuch* (1862) he was an original contributor. From 1869 until his death he was professor of German language and literature in the Munich Technical Institute. His poetic talent was genuine, and of much refinement. His intention was directed notably to rendering into the modern language the Middle High German poets, of whose thought and spirit he was a skillful interpreter. In thus continuing the work of familiarizing the mediæval literature, inaugurated by Simrock, he translated the *Tristan* (1877; 3d ed. 1901) and Wolfram von Eschenbach's *Parzival* (1898). The epic *Lanzelot und Ginevra* (1860; done into English by Bruce, London, 1865), and the collection *Gesammelte Dichtungen* (1900) comprise his chief original verse. He wrote also a number of important volumes in literary research—*Der Werwolf* (1862); *Deutsche Sage im Elsass* (1872); *Aristoteles in den Alexanderdichtungen des Mittelalters* (1890); and others.

HERTZBERG, hĕrts′bĕrk, Ewald Friedrich, Count (1725-95). A Prussian statesman and historian, born at Lottin, near Neustettin. He occupied various positions under the Prussian Government during the reigns of Frederick the Great and Frederick William II. He was one of the guiding spirits in the diplomacy of the Seven Years' War, and signed the treaty of Hubertsburg (February 15, 1763). He wrote a number of works of historical character, of which the most famous is his *Mémoire raisonné* (1756), based on dispatches between the Courts of Vienna and Dresden, in which he justifies the Prussian invasion of Saxony.

HERTZBERG, Gustav Friedrich (1826—). A German historian and archæologist. He was born at Halle, and from 1843 to 1848 studied in the university there and at Leipzig. He became privat-docent of history at Halle in 1851, and taught also in a gymnasium until 1855. In 1858 he became editor of the *Preussisches Wochenblatt.* In 1860 he was appointed professor of history at Halle. Among his writings are: *Alkibiades, der Staatsmann und Feldherr* (1853); *Das Leben des Königs Agesilaos II. von Sparta* (1856); *Geschichte Griechenlands unter der Herrschaft der Römer* (1866-75); *Geschichte der Perserkriege* *nach den Quellen erzählt* (1877); *Geschichte Griechenlands vom Absterben des antiken Lebens bis zur Gegenwart* (1876-79); *Rom und König Pyrrhos* (1871); *Die Feldzüge der Römer in Deutschland* (1872); *Geschichte von Hellas und Rom* (1879-80); *Geschichte des römischen Kaiserreichs* (1880-82); *Geschichte der Byzantiner und des Osmanischen Reichs* (1882-84); *Geschichte der Stadt Halle* (1889-93); and *Kurze Uebersicht über die Geschichte der Universität Halle* (1894).

HERTZKA, hĕrts′kȧ, THEODOR (1845—). An Austrian political economist, born at Pest. He studied at Vienna and at Pest, was editor of the economics section of the *Neue Freie Presse* of Vienna from 1872 to 1879, and in the latter year established the *Wiener Allgemeine Zeitung*, which he edited until 1886. His earlier volumes, such as *Die Gesetze der Handels- und Socialpolitik* (1880), recommend for Austria free trade and a gold-standard currency. In his *Gesetze der sozialen Entwicklung* (1886), he promulgated ideas of social reform which he extended in *Freiland, ein soziales Zukunftsbild* (1890, 10th ed. 1896), the description of a communistic Utopia located in Central Africa. His summons to the formation of such a colony resulted in the organization of nearly a thousand unions for the realization of that object, general direction of the enterprise being assigned to a central committee. An attempt toward the execution of the plans was made in 1893, but failed. The *Reise nach Freiland* (1893; Nos. 3051-62 of Reclam's *Universalbibliothek*) was an amplification by Hertzka of the previous volume.

HERULI, hĕ-rōō′lē, or **ERULI.** A savage, undisciplined, and warlike tribe of Germanic stock that appears frequently in history from the third to the sixth century A.D. We first hear of them as settled north of the Black Sea at about the middle of the third century, and joining in the marauding expeditions of the Goths on the eastern confines of the Roman Empire. In the following century they were subjugated by Hermanrich, King of the Ostrogoths, and later still allied themselves with the Huns, and fought in the battles of Attila. (See ATTILA.) By this time their main body had moved to the west, and was settled in the middle basin of the Danube in close proximity to the Gepidæ, with whom they formed a sort of loose alliance. They joined in large numbers the army of Odoacer and helped to overthrow the Western Empire in 476. Their Danubian kingdom was destroyed by the Lombards in the sixth century, and the race was dispersed, soon disappearing from view. Most of them had been converted to Christianity under the Emperor Justinian. Consult: Aschbach, *Geschichte der Heruler und Gepiden* (Frankfurt, 1835); and Hodgkin, *Italy and Her Invaders* (Oxford, 1880-99).

HERVAS Y PANDURO, ȧr-väs′ ē pȧn-dōō′-rō, LORENZO (1735-1809). A Jesuit priest and celebrated philologist, born at Cuenca, Spain. He entered the Society of Jesus at Madrid; studied in the Jesuit College at Alcalá de Henares, devoting himself especially to linguistics and architecture; taught in the Royal College in Madrid, and at Murcia in the college of his Order. Soon after he went to America as a missionary, but in 1767, by the expulsion of his society, he was driven to Rome, where he studied mathematics, physics, and afterwards linguistics. In 1799 he returned to Barcelona and after a few months there to his native town. But in 1803 or 1804 he again went to Rome, and Pius VII. made him librarian of the Quirinal, where hard work hastened his death. He may be called the founder of comparative philology in Spain and Italy, because of his *Catálogo de las lenguas conocidas;* the *Vocabulario poliglota;* an *Ensayo práctico de las lenguas;* and *Origen, formación, mecanismo, y armonía de los idiomas.* He wrote both in Italian and Spanish. His most famous work was *Idea del' Universo* (1778-87), a huge treatise on cosmography. He wrote: *La escuela española de sordo-mudos ó arte para enseñarles á escribir y hablar el idioma español* (1795), which was followed by other educational works for deaf-mutes; *Descripción de los archivos de la corona de Aragón en Barcelona,* etc. (1801); and the following unedited works: *Historia de la escritura; Paleografía universal; Moral de Confucio;* and *Historia de las primeras colonías de América.*

HERVÉ, ȧr′vȧ′, AIMÉ MARIE EDOUARD (1835-99). A French journalist, born at Saint Denis, Réunion Island. He was successively editor of the *Courrier du Dimanche* (1863); *Le Temps* (1864); *L'Epoque* (1865); after which the Government censorship silenced him in France till, in 1867, he, with J. J. Weiss, founded *Le Journal de Paris.* On Weiss's withdrawal he edited that paper alone until 1873, when he founded *Soleil,* which he conducted with great ability. He was elected to the Academy in 1886. Hervé was a supporter of a liberal constitutional monarchy, and wrote in this connection a history of liberal ideas in England, *Une page d'histoire contemporaine* (1869).

HERVÉ (properly FLORIMOND RONGER) (1825-92). A French musical composer, librettist, and comedian. He was born at Houdain, near Arras, went to Paris when a child, studied vocal and instrumental music under Saint-Roch, and was for eight years organist of Saint-Eustache. He made his début as a composer with a light opera, *Don Quichotte* (1848), and in 1851 was made leader of the Palais-Royal orchestra. Three years afterwards he assumed the direction of the Folies-concertantes on the Temple Boulevard, and became literally man of all work, as he wrote the score and the words, delivered both, led the orchestra, painted and shifted scenery. His first great success was in his original rôle of *Le compositeur toqué,* and he produced a number of light operas, such as *L'œil crevé* (1867) and *Le petit Faust* (1869), performances not lacking in melody, imagination, and originality. Hervé was the originator of French opera bouffe, but his work was afterwards overshadowed by that of Offenbach.

HERVÉ RIEL. The hero of Browning's poem of the same name (1867). He was a Breton sailor, who, in 1692, guided the French fleet safely into the port of Saint-Malo after the battle of La Hogue, and asked only a day's holiday as a reward.

HERVEY, hĕr′vĭ, ELEANOR LOUISE MONTAGU (1811—). An English poet, wife of Thomas Kibble Hervey, the poet. When but fourteen years of age, she began writing verses and tales for the different annuals and 'keepsakes' of her time, but her most ambitious attempt was a dramatic poem in six acts called *The Landgrave*

(1839). She also published an autobiographical novel and a complete edition of her husband's poems (1866).

HERVEY, James (1714-58). A clergyman of the Church of England. He was born at Hardingstone, near Northampton, February 26, 1714, educated at Northampton grammar school and Oxford, where he came under the influence of John Wesley, and for some time manifested inclination toward his theological opinions; but ultimately he adopted a thoroughly Calvinistic creed, and resolved to retain his connection with the Established Church. In 1743 he became curate to his father at Weston Favell, near Hardingstone, and succeeded him in 1752. His works have slight literary or theological value, but rapidly became popular. His earliest work, *Meditations and Contemplations* (1745-47), comprising *Meditations Among the Tombs, Reflections in a Flower Garden, A Descant on Creation*, and *Contemplation on the Night and Starry Heavens*, passed through fourteen editions in as many years. *Theron and Aspasio* (1755), which was equally well received, called forth some adverse criticism, even from the Calvinists, on account of tendencies which were considered to lead to Antinomianism, and was strongly objected to by Wesley. His *Works* appeared in six volumes (Edinburgh, 1769, later edition, 1834). He died at Weston Favell, December 25, 1758.

HERVEY, John, Lord Hervey of Ickworth (1696-1743). An English politician, the eldest son of John, first Earl of Bristol. He was educated at Cambridge and afterwards traveled abroad. After his return to England he frequented the Court of the Prince of Wales at Richmond, and in 1720 married Mary Lepell, maid of honor to the Princess. He entered the House of Commons in 1727 as member for Bury Saint Edmunds, and at first opposed Walpole, though he was brought over by a pension, the office of vice-chamberlain (1730), and a seat in the House of Lords (1733). In 1740 he replaced Lord Godolphin as Lord Privy Seal, and held this office until Walpole's fall from power in 1742.

Hervey was an intimate friend of the Queen, and had a good deal of influence at Court. He was a man of doubtful morals, and no religion, but intellectually by no means justified Pope's bitter epithets of Lord 'Fanny,' 'Sporus,' and 'Narcissus.' The wordy quarrel between Hervey and the poet was probably concerning Lady Mary Wortley Montagu, to whom the former was friendly for many years. During his political career Hervey wrote a number of vigorous controversial pamphlets. His *Memoirs* were not published until 1848. They are ably written, in a cynical style throughout, and contain valuable information about the inner Court life of his time.

HERVEY-SAINT-DENYS, âr'vā' săN' de-nē', Marie Jean Léon, Marquis d' (1823-92). A French historian and Orientalist, born in Paris. He studied Eastern languages in the College of France, and in 1867 was sent as commissioner-general to China, the country in whose literature and history he became a specialist. In 1874 he was made professor of Chinese in the College of France, and four years afterwards was elected a member of the Académie des Inscriptions et Belles-Lettres. His first publications were translations from the Spanish; but after the publication of his *Recherches sur l'agriculture des Chinois* (1851), he rendered invaluable aid to students of Chinese literature by his translations of the native prose and poetry, ending with six novels translated from the Chinese in 1892.

HERVIEU, âr'vyẽ', Paul Ernest (1857—). A French author, born at Neuilly-sur-Seine. He studied at the Lycée Condorcet, was admitted to the bar in 1877, and in 1879 became connected with the secretary's office of the presidency of the Council. In 1881 he was appointed secretary to the French Legation in Mexico, from which post he resigned in the same year. His first literary work was done, with some success, as a contributor to numerous periodicals, under the pseudonym 'Eliacin.' He afterwards collected a series of essays, first published in the *Gaulois*, as *La bêtise humaine* (1884). His books, involved in manner, but frequently praised for their skillful character-drawing, include: *Les yeux verts et les yeux bleux* (1886); *L'inconnu* (1887); *Deux plaisanteries* (1888); *L'exorcisée* (1891); *Peints par eux-mêmes* (1893); *L'armature* (1895); *Le petit duc* (1896); and *Amitié* (1900). Among the best known of his dramas are: *Les tenailles* (1894); *La loi de l'homme* (1897); and *La course de flambeau* (1900). In 1900 he was elected to the French Academy.

HERVIEUX, âr'vyẽ', Auguste Léopold (1831—). A French advocate and author. He was born at Elbeuf; was educated at the Lyceum of Rouen, and studied law in Paris, where he afterwards had some important cases. He was elected municipal councilor for the Saint Vincent De Paul District in 1884, and retired to private life in 1890. His writings are mainly upon literary subjects, such as: *Premiers essais poétiques* (1853); *Mémoires d'une femme du monde* (1860); *Poésies complètes* (1866); *Théâtre complet* (1867); *Les déclassés* (1882); *Les fabulistes latins depuis le siècle d'Auguste jusqu'à la fin du moyen âge* (1883-90); *Harmonies intimes* (1889); *Etapes amoureuses d'un sonnetiste* (1889); *Des pécules du fils de famille dans la législation romaine* (1890). Between 1860 and 1870 he wrote under the nom-de-plume 'Saint-Amand.'

HERVILLY, âr'vē'yē', Marie Ernest d' (1839—). A French poet, romancer, and playwright, born in Paris. He was educated for civil engineering, but left his railroad appointment and his overseeing of bridges and highways to go into journalism. Thence he emerged as a poet with such work as *La lanterne en vers de couleur* (1868), and *Bêtes à Paris* (1886), while he made his name as a novelist with *Mesdames les parisiennes* (1875) and *La dame d'Entremont* (1884), after which he wrote acceptably for young people—*Jack-le-Gal et ses contes* (1891), for example. He wrote also a number of one-act comedies in verse that have met with favorable receptions, such as: *Le magister* at the Théâtre Français, *Le bibelot* at the Palais-Royal, in 1877, and *Molière en prison* at the Odéon, 1886.

HERWARTH VON BITTENFELD, hĕr'värt fōn bĭt'ten-fĕlt, Karl Eberhard (1796-1884). A Prussian general. He was born at Grosswerther in Prussia, and entered the army in 1811. He gained his first laurels in the War of Liberation, especially in the battle of Leipzig. In 1848 he commanded the First Regiment of the Guards. During the war with Denmark in 1864 he acquired fame through his daring crossing of the Sound and capture of the Isle of Alsen. In the campaign of 1866 he was in command of the right wing of the army which advanced into Bohemia. He bore the brunt of the fighting at Hühnerwasser and Münchengrätz, and contributed materially to the victory of Sadowa. On the outbreak of the war of 1870 he was appointed Governor of the Rhenish Provinces, and in the next year he was raised to the rank of general-field-marshal.

HERWEGH, hĕr'vȧk, Georg (1817-75). A German poet. He was born at Stuttgart; was educated there and at Maulbronn, forsook theology, which he had begun to study, for literature, and returned to Stuttgart, where he coöperated in Lewald's *Europa.* In 1841 he was living in Switzerland and published *Gedichte eines Lebendigen* (last ed. 1896), political poetry full of the unrest, the dissatisfaction with the existing conditions, and the uncertainty as to what should take its place, that marked the period. These fervent effusions became immensely popular, so that when, after a short trip to Paris, Herwegh journeyed through Germany in 1842, he was greeted with enthusiasm everywhere. King Friedrich Wilhelm IV. gave him an audience, and assured him that he liked nothing better than an energetic opposition. But the young man overstepped all the bounds of conventionality in a letter to the King, and was hurried out of Prussia. At Zurich he found no pleasant reception, and he took up his abode in Paris, and wrote a second volume of *Gedichte eines Lebendigen* (1844). In this his republican tendencies were more plain than ever, but his inspiration seemed weaker. He translated all of Lamartine into German (1843-44). After the Revolution of February, 1848, Herwegh made several attempts to carry out his republican ideas by invading Baden at the head of a legion of German and French workingmen, but was defeated by the Württemberg troops, and escaped only through the bravery of his wife. Thereafter he lived in retirement in Paris, and later in Zürich and at Lichtenthal, near Baden-Baden. The most important work of his later years was the translation of many of Shakespeare's plays. Consult Marcel Herwegh, *Briefe von und an Georg Herwegh* (Zurich, 1896).

HERZ, hĕrts, Henri (1806-88). A French pianist, born in Vienna. He studied music under Hünten at Coblenz and at the Paris Conservatory, where he won first prize for piano-playing. He made a number of tours which were highly successful: in Germany, with the violinist Lafont (1831); in London, appearing with Moscheles and Cramer (1834); in the United States, Mexico, and the West Indies (1845-51). From 1842 to 1874 he was professor of piano-playing at the Paris Conservatory. He founded a piano factory, and in 1855 his instruments received first prize at the Paris Exhibition. Herz's compositions were confessedly written to catch the popular fancy, and, though they succeeded, have little permanent value. His best works were *Etudes,* and exercises for the piano. He published *Mes voyages en Amérique* (1866), a series of letters describing his American tour.

HERZ, Henriette (1764-1847). A German woman, distinguished for her rare beauty and cultivation, as well as by her relations to many of the most distinguished men of her time. She was born in Berlin, the daughter of a Jewish physician, Benjamin de Lamos, and at fifteen years of age became the wife of Markus Herz, a rich and elderly physician. Her home became the centre of the literary life of Berlin, and such men as the Humboldts, Friedrich and August Wilhelm Schlegel, Fichte, Varnhagen von Ense and his wife Rachel, Schleiermacher, and Börne were her intimate friends. She was left a widow in 1803, and became a Christian in 1817. Consult Fürst, *Henriette Herz: Ihr Leben und ihre Erinnerungen* (Berlin, 1850).

HERZEGOVINA, hĕr'tsȧ-gō-vē'nȧ. The smaller of the two Ottoman provinces occupied by Austria-Hungary, in accordance with the treaty of 1878 (Map: Austria-Hungary, F 5). It forms part of Bosnia in the wider sense. It is bounded by Bosnia proper on the north, by Montenegro on the east, and Dalmatia on the southwest. Its area is 3530 square miles. In the formation of its surface it resembles Bosnia (q.v.). It is generally somewhat barren, and is mountainous, having a number of peaks exceeding 7000 feet in height, the highest being the Maglić on the eastern boundary, which rises about 7850 feet above the sea. The eastern part is especially barren and rocky, in contrast with the part adjoining Bosnia and Dalmatia, which is fertile, and invites the cultivation of the vine, tobacco, and southern fruits. In this latter district is found the largest river, the Narenta, whose valley forms the characteristic feature of the region. Administratively Herzegovina is a dependency of Bosnia, and forms (within reduced limits) the district of Mostar. There are no official figures for the population, but its number may be set down at approximately 200,000. The great bulk of the inhabitants are Slavs. The largest town is Mostar (q.v.), which is connected by rail with Serajevo, the Bosnian capital.

Herzegovina was originally a part of Dalmatia and was occupied by a Slavic population in the seventh century. The most important of the mediæval principalities of the region was that of Zachlum or Chulm, which in the fourteenth century was annexed to Bosnia. Regaining its independence, Herzegovina was erected into a dukedom by the Emperor Frederick III. in 1440. (Hence the name Herzegovina, from Ger. *Herzog,* Slav. *herceg,* duke.) About 1463 the country became tributary to the Turks, and twenty years later was completely subject to them, remaining for more than two centuries afterwards a battlefield between Christians and Mohammedans. In 1875 a serious insurrection, arising from the Turkish oppression of its Christian inhabitants, broke out in Herzegovina, which rapidly spread into Bosnia, and was supported by Montenegro and Servia. This ultimately led to the war of 1877-78 between Russia and Turkey. The Berlin Congress of 1878 determined that Herzegovina, like Bosnia, should be occupied by Austria-Hungary. The Mohammedan inhabitants rose against the Austrian army of occupation, and were subdued only after a desperate resistance. The introduction of a new recruiting law was the occasion for an insurrection in 1881-82. The Austro-Hungarian Government has done much to promote the welfare of the region. See Bosnia.

HERZEN, hĕrts'en, Alexander Ivanovitch (1812-70). A Russian publicist and author, born at Moscow. He was the illegitimate child of a rich nobleman, Ivan Alexeyevitch Yakovlyeff. He received the fashionable French education of the time, and while at school became a great admirer of the contemporary French socialists. Arrested in 1834 with his comrades, he was sent to Perm and then to Viatka, where he held a position in the Governor's office. Transferred to Vladimir, he married, bringing his bride secretly from Moscow. In 1840 he was allowed to return to Moscow. A close study of Hegel, whose teachings were then in the ascendency, brought him to conclusions quite opposite to those of most of his friends. Under the influence of the doctrines of Proudhon, Cabet, and Louis Blanc, he became a rabid Westerner as distinguished from the Slavophils. He resigned his Government position in 1842, and left Russia in 1847, after having published, under the pseudonym of 'Iskander,' two works on philosophy as well as several novels. He settled in Paris, was in full sympathy with the events of 1848, although not actively engaged in them, and later was on intimate terms with Proudhon, Garibaldi, as well as with many revolutionists in France, Italy, and Switzerland, and carried on a systematic agitation against the absolutist Government of Russia. Forced by the police to leave Paris, he was naturalized in Switzerland, and, founding a free press in London, published after 1857 his weekly *Kolokol* ("The Bell"). From 1864 to 1867 he published it at Geneva, and moved to Paris in 1869, where he soon died of pneumonia. His literary activity began as early as 1830. His works are strikingly brilliant, characterized by depth of thought and artistic form. His best-known novel, *Who Is to Blame?* deals with the questions of freedom of feelings, family relations, and woman's position in wedlock. The dominant idea is that it is futile to seek happiness by locking one's self up within the narrow family interests away from society and the world. A great admirer of Western civilization, he was completely disappointed in it when viewing it at close range, and was disgusted with the mercantilism of the *bourgeoisie*, but saw a bright future for the working classes, and expected much from the regenerative power of Russia, with her communistic village system of the *mir*. These ideas he embodied in his *Vom andern Ufer* (1850; published in Russian, 1855; in French, 1870); and in his *Letters from France and Italy*, in which he gives a keen analysis of the causes that brought on the revolutionary events of the time. He was a freethinker in the broadest sense of the word, hence his negative attitude toward all parties and creeds. His influence was overwhelming, the greatest secrets of the State and the Imperial household immediately finding their way into his paper, a copy of which was very often placed in the Emperor's room. But his popularity was undermined by his advocacy of the Polish rebellion, he having for a long time stubbornly refused to lend any assistance, until finally persuaded by his friend Bakunin (q.v.). The circulation of the *Kolokol*, from over 3000 fell to about 500, and Herzen finally stopped its publication. Besides the works mentioned, the following are among his best: *Dilettantism in Science* (1842): *Letters on the Study of Nature* (1845-46); *From the Memoirs of Doctor Krupoff* (1847); *Recollections of My Travels* (1848); *On the Development of Revolutionary Ideas in Russia* (1851); *Baptized Property* (1853), or "Serfism"; *Prison and Exile* (1854); *My Exile* (1855); *Interrupted Tales* (1856); *France or England* (1858); *The Old World and Russia;* and *The New Phase of Russian Literature* (1864). His collected works in Russian were published in ten volumes at Geneva (1875-85). *Who Is to Blame?* was published at Saint Petersburg in 1891, his correspondence with his friends in the *Monthly Russian Thought* in 1890. In French his works appeared as follows: *Mémoires*, vols. i.-iii. (Paris, 1860-62); *Récits et nouvelles* (ib., 1873). The *Kolokol* appeared at Brussels in 1863-65, under the title *Cloche*. For a biography, consult: Eckhardt, in *Jungrussisch und Altlivländisch* (Leipzig, 1871); and Sperber, *Die sozialpolitischen Ideen A. Herzens* (Leipzig, 1894).

HERZLIEB, hĕrts′lēb, Minna (1789-1865). A friend of Goethe, who addressed to her several of his sonnets, and in his *Wahlverwandtschaften* is supposed to have represented her under the name *Ottilie*. Consult Gädertz, *Goethes Minchen* (Bremen, 1888).

HERZOG, hĕr′tsōG, Eduard (1841—). First bishop of the Old-Catholic Church of Switzerland. He was born at Schongau, Switzerland, August 1, 1841. He studied theology at Tübingen and Freiburg; was ordained priest in the Roman Catholic Church, 1867, and was professor of exegesis in the theological seminary at Lucerne (1868-72). He joined the Old Catholic organization (1872), and was pastor of Old Catholic churches at Krefeld, Germany (1873), and at Olten, Switzerland (1874), and professor of New Testament exegesis in the Old Catholic faculty at the University of Bern. He was called to be bishop by the national synod in 1876. He has written many polemical and controversial articles.

HERZOG, Ernst von (1834—). A German classical philologist, born at Esslingen. He was appointed a professor in the University of Tübingen in 1867. His publications relate chiefly to the constitutional history of Athens and Rome. The most important among them are: *Galliæ Narbonensis Historia* (Leipzig, 1864); *Geschichte und System der römischen Staatsverfassung* (ib., 1884-91); *Zur Verwaltungsgeschichte des attischen Staats* (Tübingen, 1897).

HERZOG, Hans (1819-94). A Swiss general, born at Aarau, and educated there. His enforced military service in 1839 interested him in the art of war; he volunteered in the Württemberg artillery in 1846; and in 1860 was appointed by the Federal Council chief of the Swiss artillery. He introduced new arms for both infantry and artillery. At the beginning of the Franco-Prussian War he was put in command of nearly forty thousand men to guard the Swiss frontier, and vigorously opposed the disbanding of more than half this force in August, 1870. At the beginning of 1871 he commanded at the French frontier, and entered into a convention with General Clinchant at Verrières by which Bourbaki's army was allowed to cross into Swiss territory on laying down its arms. His experiences of this year made him more eager than ever in his attempts to better the condition of the army in his old post of chief of artillery. He died at Aarau. Consult Bluntschli, *Karl Johann Herzog* (Zurich, 1895).

HERZOG, JOHANN JAKOB (1805-82). A religious editor and scholar. He was born at Basel, September 12, 1805. He studied at Basel and Berlin, and filled the position of professor of historical theology at Lausanne, Halle, and Erlangen. He retired in 1877, and died at Erlangen, September 30, 1882. He was a voluminous writer, and published a sketch of Calvin (1843), a life of Œcolampadius (1843), works on the Waldenses (1848 and 1853), and *Abriss der gesamten Kirchengeschichte* (1876-87; 2d ed. by Koffmann, 1890-92). His greatest work was the religious encyclopædia known as *Real-Encyclopädie für protestantische Theologie und Kirche* (22 vols., Gotha, 1853-68; 3d ed. by A. Hauck, 1896 et seq.; 12th vol. 1902), of which he was editor and to which he contributed 529 articles.

HERZOG, KARL JOSEPH BENJAMIN (1827-1902). A German statesman, born at Brieg and educated at Breslau. He was assistant in the ministerial Department of Commerce (1859) and representative of the North German Federation at the Paris Exposition (1867); in 1871 he was a member of the commission on the government of Alsace and Lorraine, and later (1876) became Assistant Secretary of State in the department for these provinces, and (1879) Secretary of State in their first Ministry, from which he resigned a year later because of his opposition to the policy of Von Manteuffel. He traveled in America (1881-82), and wrote *Reisebriefe aus Amerika* (1884).

HERZOGENBERG, hĕr-tsō′gen-bĕrk, HEINRICH VON (1843-1900). An Austrian musician, born at Gratz. He studied at the Vienna Conservatory (1862-64), and in 1874, at Leipzig, founded the Bach-Verein in conjunction with Spitta, Holstein, and Volkland. In 1875 he succeeded the latter as its director. He was professor of composition at the Berlin 'Hochschule für Musik' (1885-92); and also a member of the Akademie, and president of the 'Meisterschule' for composition. His compositions include: The oratorio, *Die Geburt Christi;* a symphonic poem, *Odysseus;* two symphonies; and many psalms for chorus and orchestra, and instrumental pieces.

HERZOG ERNST, hĕr′tsôg ĕrnst. A poem of the twelfth century of Bavarian origin, but of unknown authorship. Its subject is the exploits of Ernst of Swabia in the Orient during his banishment.

HESEKIEL, hâ-zä′kê-ĕl, GEORG LUDWIG (1819-74). A German novelist, born at Halle, the son of Friedrich Hesekiel, a religious poet, and educated at Halle, Jena, and Berlin. He was editor of *Die Rosen* at Altenburg (1846), of the *Patriotischer Hausfreund* at Zeitz (1848), of the Berlin *Kreuzzeitung* (1849), and of the *Berliner Revue* (1855); but he is best known for his poems and novels, which are marked by a distinctly conservative and monarchical patriotism. Among the former are: *Gedichte eines Royalisten* (1841); *Zwischen Sumpf und Sand* (1863); *Aus dem Dänenkrieg* (1864); *Neue Gedichte* (1866); and *Gegen die Franzosen* (1870). His novels include: *Das liebe Dorel* (1851); *Vor Jena* (1859); *Von Jena nach Königsberg* (1860); *Stille vor dem Sturm* (1862); *Unter dem Eisenzahn* (1864); *Refugiert und emigriert* (1869); *Graf d'Anethan d'Entragues* (3d ed. 1861); *Von Turgot bis Babeuf* (2d ed. 1873); and *Lilienbanner und Tricolore* (1859). He also wrote *Das Buch vom Grafen Bismarck* (3d ed. 1873).

HESEKIEL, LUDOVICA (1847-89). A German novelist, daughter of the above, born at Altenburg. She early entered journalism, and in literature devoted herself to historical fiction and to biography. She married Wilhelm Johnsen, pastor at Neustadt, in 1887. Among her novels the most important are: *Eine brandenburgische Hofjungfer* (1868); *Von Brandenburg zu Bismarck* (1873); *Unterm Sparrenschild* (3d ed. 1893); *Deutsche Träumer* (2d ed. 1897); *Prinz Wilhelm* (2d ed. 1897); *Jesus meine Zuversicht* (3d ed. 1894); *Des Kaisers Gast* (3d ed. 1894); and *Andernach und Clairveaux* (1889). She also wrote the sketches *Barackenleben* (1872), and the biographies, *Elisabeth Luise* (1881), *Agnes Fürstin Reuss jüngerer Linie* (1887), and *Augusta, Kaiserin-Königin* (1890).

HE′SIOD (Gk. Ἡσίοδος, *Hēsiodos*). After Homer, the earliest Greek poet whose works have survived. The date at which he lived is uncertain. Herodotus regarded him as contemporary with Homer, and dated both of these at 400 years before his own day, i.e. in the middle of the ninth century B.C. Ephorus thought him older than Homer; the Parian Marble also takes this view and makes him thirty years the elder; but the Alexandrians, Eratosthenes, and Aristarchus, held that the treatment of the myths and the geographical knowledge shown in Hesiod's works proved him to be younger. Modern criticism has shown clearly that the Hesiodic works exhibit a knowledge of the *Iliad* and *Odyssey* in their present Ionic dialect, and in very much their present form; on the other hand, it is certain that Hesiod's *Works and Days* were known to Simonides and Archilochus, so that we may safely place Hesiod in the second half of the eighth century, or perhaps about B.C. 700.

Our knowledge of his life is derived almost solely from his poems; the ancient scholars had no better source of information. From notices in his *Works and Days*, and other scattered sources, we learn that his father, under stress of poverty, came to Bœotia as an emigrant from Cyme, an Æolian town in Asia Minor, and settled in the petty village of Ascra beneath Mount Helicon. Here probably Hesiod was born. In his youth he watched the sheep on Helicon. At his father's death his brother Perses succeeded in cheating him of his proper inheritance by corrupting the judges; but later, this unjust brother was reduced to such poverty that he was forced to appeal for aid to Hesiod. Under the impulse of his homely muse, Hesiod, like other early bards, became a wandering singer, visiting not simply the cities of his native Bœotia, but also traveling to the west past Delphi, until he reached Naupactus in Ozolian Locris. Tradition says that the Delphic oracle had warned him that he was destined to die in the shrine of the Nemean Zeus; but the poet in the course of his travels came to Œneon in Locris, quite unaware that here also was a temple of the god whose sacred precinct he was to avoid. In this town he is reported to have met his death at the hands of two brothers who without foundation suspected him of wronging their sister. The tradition may well have this truth, that Hesiod died in Locris. At Naupactus a school of Hesiodic poetry developed, one product of which was the genealogical poem *Ναυπάκτια*, fragments of which are embodied in the Scholia to Apollonius Rhodius. In later times a grave of Hesiod was to be seen in the market-place at Orchomenus, to which tradition said the poet's bones had been removed at the command of the Delphic Oracle.

Hesiod was the founder of Greek didactic poetry, as Homer of epic song. The following works are extant under his name: *Works and Days* (*Ἔργα καὶ Ἡμέραι*) in 828 verses, which the Bœotian tradition on Helicon regarded as his only genuine work. The first part of its name (*Works*) comes from the directions for various kinds of labor which it contains; the second (*Days*) is due to the calendar it gives, showing the days of the month on which certain tasks should be performed. The poem in its present form no doubt contains some later additions, but scholars are not agreed as to the extent of these interpolations. The *Theogony* (Θεογονία) in 1022 verses is an attempt to bring Greek mythology into an ordered system, and to incorporate into the ranks of the older divinities the new gods from abroad, which were not known to the Homeric poems. In it theosophic and cosmogonic speculations are combined with ancient hymns and accounts of cults. Under the epic form Hesiod gives a history of the creation and of the generations of the gods; the close of the poem contains a list of the daughters of Zeus, who bore sons to mortals. We have to regret the loss of the *Catalogue of Women* (Γυναικῶν Κατάλογος), which gave a list of the mortal women who had become the mothers of heroes, and some account of these heroes' exploits. The poem was divided into five books, of which probably the last two bore the special title Ἠοῖαι from the fact that each division began with *ἢ οἵη*, 'or such a woman.' The extant *Shield of Hercules* (Ἀσπὶς Ἡρακλέους) in 480 verses borrowed its introduction from the fourth book of the preceding work. The greater part of the poem is occupied with an account of the shield of Hercules, which is an inferior imitation of the description of Achilles's shield in the *Iliad*. There were a number of other Hesiodic poems in antiquity; of these only scanty fragments are left. The *Contest Between Homer and Hesiod* (Ὁμήρου καὶ Ἡσιόδου Ἀγών) usually printed with Hesiod's works is a product of the time of Hadrian.

Hesiod exhibits none of the splendid imagination and vivid power of Homer; his verses are filled with sayings and homely precepts; they offer a calendar and a mythology for the common people. But the form is the same as that of the Homeric poems and the dialect on the whole shows little divergence. Hesiod was, however, highly prized for his moral precepts, and the poems played an important part in Greek education. Their influence, especially that of the *Works and Days*, was not confined to Bœotia and Locris, where a Hesiodic school developed, but extended to Ionia, and can be seen in the development of iambic poetry. The poems formed the subject of learned comment from the Alexandrian Age to the Byzantine period. The best editions are by Lennep (Amsterdam, 1843); Schömann (Berlin, 1869); Flach (Berlin, 1874); Göttling-Flach (Leipzig, 1878); Rzach (Leipzig, 1884); Sittl (Athens, 1890). There are translations of the *Works and Days* by Chapman (London, 1858); of the entire poems by Elton (2d ed., London, 1832), and by Banks (London, 1892). Consult also: Fick, *Hesiod's Gedichte* (Göttingen, 1887); Grote's *Greece*, vols. i. and ii. passim (5th ed., London, 1888); and the histories of Greek literature.

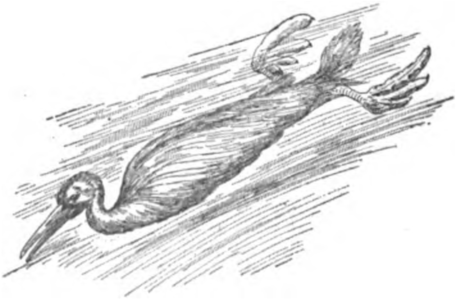
HESPE′RIA (Lat., from Gk. **Ἑσπερία**, from **ἑσπέρα**, *hespera*, **ἕσπερος**, *hesperos*, west, Lat. *vesper*, evening; probably connected ultimately with OHG. *westan*, Ger. *Westen*, Eng. *west*, and with Gk. **ἄστυ**, *asty*, city, Skt. *vāstu*, house, from *vas*, to dwell). The land of the west, a term applied by the ancient Greek poets to Italy, and by the Roman writers sometimes to Italy and sometimes to the Iberian Peninsula.

HESPERIDES, hĕs-pĕr′ĭ-dēz (Lat., from Gk. **Ἑσπερίδες**, *Hesperides*, *from* **ἑσπέρα**, *hespera*, evening). In the earliest version, the daughters of Night, who on an island far beyond the western ocean guard with the dragon Ladon the golden apples, symbol of love and fruitfulness, which Gæa produced as a wedding gift for Zeus and Hera. The number and names varied, but the common version seems to have known three, Ægle, Erythea, and Hesperethusa. Later genealogists represented them as daughters of Atlas, who was also localized in the far West. With the aid of Atlas Hercules secured three of the apples for Eurystheus, but they were restored by Athena.

HESPERIDES. The title of the collection of Robert Herrick's poems published in 1648. It contains his most charming lyrics and the larger part of his work, filling two volumes of the fine edition by Grosart (1876).

HES′PERIS. See DAME'S-VIOLET.

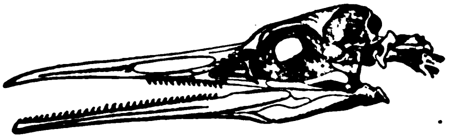
HESPERORNIS, hĕs′pĕr-ŏr′nĭs (Neo-Lat., from Gk. **ἕσπερος**, *hesperos*, west + **ὄρνις**, *ornis*, bird). A primitive, flightless, toothed sea-bird, found fossil in the Middle Cretaceous shales of western Kansas, and, excepting Archæopteryx, the oldest bird known. The first skeleton was discovered in 1871 by Prof. O. C. Marsh, near the Smoky Hill River, in marine deposits of yellow chalk and calcareous shales, and was named *Hesperornis regalis*. Several other species have since become known; and Enaliornis, of the Upper Greensand of Cambridge, England, appears to be a closely allied form. It was a large, well-feathered water-bird, having the general habits of a loon, perhaps, ranging the open sea, and scrambling upon land only for breeding. Its food was mainly fishes, which it pursued by swimming and diving, for it had no wings. There is reason to believe that this winglessness was



THE HESPERORNIS.

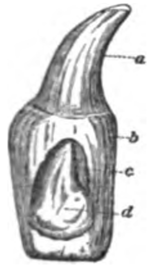
After a drawing by Joseph Gleeson, representing an ideal figure, in the attitude of swimming; based upon skeletons in the National Museum.

due to degeneracy from fully winged ancestors. Hesperornis was more than five feet in length, and if its ancestors were equally bulky their wings were quite too large to use under water, but would be folded close against the body when the bird dived or swam. This constant disuse, as the race became more and more exclusively aquatic, would permit the wings to dwindle. By the time the wings were small enough to be of use as paddles under water, as modern auks use theirs, the muscles had become too feeble to move them in so dense a medium, and so degeneration continued until only a remnant of humerus remained. Correlative with this was a constant growth and strengthening of the legs, which became of great size (though the bones remained hollow, like those of an aërial bird) and so twisted as to turn edgewise when the foot was brought forward after each stroke, thus offering least resistance to the water. The original skeleton set up by Marsh, and depicted in his *Odontornithes*, stood erect like a penguin. When an attempt was made at the National Museum to mount another skeleton in a swimming attitude, it was discovered that this position required an altogether novel arrangement of the legs, such as is shown in the accompanying sketch of a restoration based by Lucas (see above) upon this skeleton. It appears that the legs of this bird must have stood out almost at right angles, and have acted like a pair of oars.



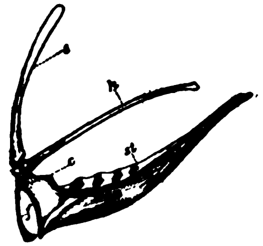
SKULL AND TOOTHED BEAK OF HESPERORNIS REGALIS.

To this most powerful apparatus for swimming and chase was added the best of means for seizing and holding the agile, slippery, and often bone-incased prey, in the form of a long neck, capable of rapid flexure and thrust, and long slender jaws, armed with sharp recurved teeth resembling those of reptiles. They were set in a common alveolar groove (holcodont dentition)—a fact which differentiates Hesperornis from the higher Ichthyornis and its relatives, whose teeth were implanted in separate sockets (thecodont). (See Bird, Fossil.) In the upper jaw the teeth were confined to the maxillary bone alone, but in the lower jaw they extended to the tip of the ramus. As this lower jaw was united in front only by a cartilage, as a serpent's, and had on each side a joint which admitted of some elbow-like motion, the power of swallowing was very extensive. The skull, though shaped like that of a loon, had many struthious characters, and the brain was distinctly reptilian in form, and only about one-third as large as that of a modern loon. The skeleton as a whole closely approximates that of modern birds. The vertebræ resemble those of a loon. The shoulder-girdle, in its original structure, as well as in its degeneracy, and the sternum, which has no keel, are ostrich-like; and it is in the pelvic arch more than elsewhere that traces of reptilian ancestry are evident. The tail contained 12 vertebræ—more than are or have been possessed by any other known bird since Archæopteryx; and they were solid, firmly locked together and winged, so that the outline of the caudal skeleton is spatulate. This, with the evidently strong musculature, would give great power, similar to that of a beaver's tail, and doubtless the organ was an important aid in swimming, by a sculling motion, as well as in steering and controlling progress.



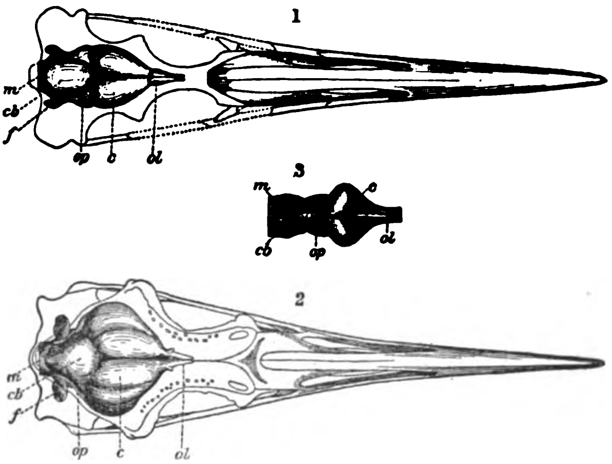
A TOOTH OF HESPERORNIS.

a, crown; b, root; c, absorbed cavity in the root, containing a young tooth (*d*).



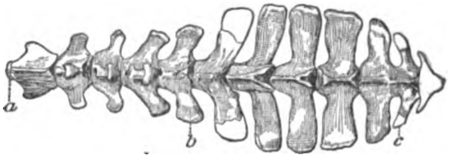
SHOULDER-GIRDLE.

Hesperornis regalis: *s*, scapula; *h*, humerus; *f*, clavicle, or furculum; *c*, coracoid; *st*, sternum.



COMPARISON OF SKULLS AND BRAINS.

1. Skull and brain-cavity of *Hesperornis regalis*, from above. 2. Skull and brain-cavity of modern loon. 3. Cast of brain-cavity of a young alligator: *ol*, olfactory lobes; *c*, cerebral hemispheres; *op*, optic lobes; *cb*, cerebellum; *f*, flocculi; *m*, medulla. (After Marsh.)



BONES OF THE TAIL.

Caudal vertebræ of *Hesperornis regalis*, seen from above: a, anterior convex face of first caudal; *b*, tranverse process.

Whether it bore quill-feathers in pairs, as did the long tail of Archæopteryx, is not known. The legs and feet resemble those of a grebe on a large scale, and it is fair to suppose that they were externally lobed in a similar way. The feathers on the legs, at least, as is known from impressions in the rocks, were soft and rather scanty.

Hesperornis survived for a long period, during which the interior of North America was a shallow sea, stretching from the Alleghanies to the Rocky Mountains, broken by little except the island summits of the Ozark Hills. Professor Marsh says that apparently there was an absence of enemies in the air to be feared by this great diver, since it was more than a match for the huge but toothless pterodactyls, which hovered over the waters in great numbers. The warm sea teemed with fishes and other food; but it also teemed with great swimming lizards (mososaurs), turtles a dozen feet in length, and large predaceous fishes. As the gradual rise of the land toward the close of the Cretaceous epoch more and more inclosed the sea and modified conditions, the struggle for life became too hard for many of its denizens, and Hesperornis was among those which early succumbed. With it disappeared forever a primitive type of bird life, for this branch of the avine stock seems to have terminated without leaving any descendants.

BIBLIOGRAPHY. The fullest descriptions and illustrations of Hesperornis are contained in Marsh, *Odontornithes: A Monograph of the Extinct Toothed Birds of North America* (Washington, 1880). Consult, also: Cope, *Cretaceous Vertebrates of the West* (Washington, 1877); Williston, various papers in the *Annual Reports of the University Geological Survey of Kansas* (Lawrence); Lucas, *Animals of the Past* (New York, 1901); Newton, *Dictionary of Birds* (New York, 1896). See BIRD, FOSSIL; and ICHTHYORNIS.

HES'PERUS (Lat., from Gk. Ἕσπερος). The name given by the Greeks to the evening star Venus. He is the son of Astræus, or Cephalos, and Eos, and the father of the Hesperides. As the morning star he is called Phosphorus (Lucifer).

HESPERUS. A surname given to the Green Knight, Sir Pertolope, in the legend of King Arthur. With his three brothers he guarded the approaches of Castle Perilous. In Tennyson's *Idylls of the King* he is called the 'Evening Star,' but his famous combat takes place at dawn.

HESS, HEINRICH, Freiherr von (1788-1870). An Austrian general, born in Vienna. He entered the army in 1805, distinguished himself at Wagram, and served in the campaigns of 1813 and 1814. In 1815 he was employed in the War Department, but soon returned to active service, and in 1821 was in the army of occupation in Piedmont. Transferred to the General Staff in 1831, he served in Lombardy, where he greatly improved the organization of the army. Hess was promoted to the rank of brigadier-general in 1834, and to be field-marshal-lieutenant in 1842. In 1849 his ability as quartermaster-general was recognized by Radetzky, as contributing largely to the success of the campaign in Italy. During operations in the East (1854-55), Hess commanded the observation corps in Galicia and Transylvania. In 1859 he was sent to Italy, and was involved in the Emperor's defeat at Solferino, but for his part in the truce of Villafranca was made field-marshal. Two years afterwards he was named a member of the House of Lords for life.

HESS, HEINRICH VON (1798-1863). A German painter, born at Düsseldorf. He studied with his father, Karl Ernst Christoph Hess (1755-1828), an engraver, born at Darmstadt. He attracted attention at an early age, and was sent to Italy in 1821 to complete his studies. In 1828 he was made professor at the Munich Academy, and in 1849 director of all the galleries in the city. The frescoes in the Basilica of Saint Boniface, twenty-two scenes from the life of that saint, in the execution of which he was assisted by Koch and Schraudolph, and those in the Church of All Saints (both in Munich), are probably his best works. He also produced other notable frescoes and many cartoons for windows. His oil paintings include: "Saint Luke," "Christmas Eve," and "Faith, Hope, and Charity." One of his best portraits is that of Thorwaldsen.

HESS, JOHANN (1490-1547). A German preacher of the Reformation, born at Nuremberg, and educated at Leipzig and Wittenberg. He returned to Wittenberg (1520), after acting as secretary to the Bishop of Breslau and traveling in Italy, where he came under the influence of the humanists. Strongly influenced by Luther and Melanchthon, he went back to Breslau, and did much for the spread of the Reformation there. Consult Köstlin, "Johann Hess, der Breslauer Reformator," in the *Zeitschrift des Vereins für Geschichte und Altertum Schlesiens,* vols. vi., xii. (Breslau, 1893-99).

HESS, hĕs'se, JOHANN JAKOB (1741-1828). A Swiss theologian, born at Zurich, where he became deacon (1777) and (1795) superintendent of the churches in the canton. He wrote original studies on the life of Christ: *Geschichte der drei letzten Lebensjahre Jesu* (1768-73); *Jugendgeschichte Jesu* (1773); and, including these, *Lebensgeschichte Jesu* (8th ed. 1822-23). Consult: Escher, *Johann Jakob Hess* (Zurich, 1837), and Zimmermann, *Die Zürcher Kirche von der Reformation bis zum dritten Reformationsjubiläum* (Zurich, 1877-78).

HESS, KARL ADOLF (1769-1849). A German animal painter and etcher, born in Dresden. He was a pupil of Kloss, traveled in Hungary, Russia, and Turkey, and afterwards became professor at the Vienna Academy. He is noted for his pictures of horses, and his drawings and sketches of those subjects are also prized.

HESS, PETER VON (1792-1871). A German battle painter, born at Düsseldorf. He was the son of Karl Ernst Christoph von Hess, the engraver, and the brother of Heinrich von Hess. He studied under his father, and then in the Munich Academy, and was with the German Army in the campaign of 1813-15. His first large picture was the "Battle of Arcis-sur-Aube" (1817). Afterwards he was appointed painter to the Bavarian Court. In 1839 he went to Russia, and painted two pictures from scenes in the War of 1812 for the Emperor Nicholas. His other works include some genre pictures; a series of oil sketches for the Munich 'Hofgarten,' representing Greek stories; "The Entrance of King Otho into Nauplia;" "Saint Leonard's Festival in Bavaria;" "Plundering Cossacks;" "A Marketing Scene;" and a "Surprise;" all minutely painted and of good color.—His brother Karl (1801-74), born at Düsseldorf, was an animal, landscape, and genre painter. Notable works by him are: "On Lake Starnberg" (1835); "A Tyrolese Landscape" and "Cattle in a Pasture" (1822), both in the National Gallery, Berlin. He was also an engraver.

HESS, Richard (1835—). A noted German forester. He was born at Gotha, studied at Aschaffenburg and at Göttingen, and at the age of twenty-three entered the forestry service at Gotha. In 1868 he was appointed director of the Academic Institute of Forestry at the University of Giessen, where he also occupied a chair as one of the professors. His chief book is *Der Forstschutz* (Leipzig, 1876-78; 3d ed., 2 vols., 1896-99). Among his numerous other writings may be mentioned: *Grundriss zu Vorlesungen über Forstbenutzung und Forsttechnologie* (2d ed. Berlin, 1901); *Der akademische Forstgarten bei Giessen als Demonstrations- und Versuchsfeld* (2d ed. Giessen, 1890); *Die Eigenschaften und das forstliche Verhalten der wichtigern in Deutschland vorkommenden Holzarten* (2d ed. Berlin, 1895); *Encyklopädie und Methodologie der Forstwissenschaft* (Nordlingen, 1885-92).

HESSE, hĕs (Ger. *Hessen*). A former landgraviate of Germany. The region was occupied in early times by the *Catti* or *Chatti* (German *Katten*). Their first appearance in history is in A.D. 15, when Germanicus destroyed their principal settlement, Mattium, the site of the present villages of Grosse and Klein Maden, near Gudensberg, in the Prussian district of Cassel. In the course of time the Catti became merged in the Frankish tribes, who, when they migrated into Gaul, left Hesse uninhabited, whereupon the Saxons took possession. The Carolingians ruled the country by means of counts, and the power soon became hereditary in one family, the head of this family being elected in 911 King of Germany as Conrad I. After his death and that of his brother Eberhard, the country fell into many divisions, until in 1137 Count Louis I. of Thuringia married the daughter of Count Geiss IV. of Gudensberg, who belonged to the most powerful family in Hesse, and soon thereafter the Hessian nobles accepted Louis as their overlord; but the Thuringian line of landgraves died out in 1247, with Heinrich Raspe, the opponent of Frederick II. In 1263, after a long contest, Sophia, niece of Heinrich Raspe, obtained full possession of Hesse, and from her son and successor, Henry I., surnamed the Child (died 1308), all the various branches of the Hessian family still trace their descent. His descendants added many valuable territories to their old patrimony. After the possessions of the house had been for a time divided, William II., in 1500, was in complete control of all Hessian territories, to which he added Homburg, and in 1509 his five-year-old son, Philip the Magnanimous, succeeded him. He was declared of age in 1518, and thereafter played a very prominent rôle in German affairs, and to some extent in Europe, being a leader in the German Reformation. (See Philip the Magnanimous and Luther.) Philip, on his death, in 1567, divided his territory among his four sons. The eldest, William IV., obtained half of the Hessian domains, with Cassel for his residence; Louis, a fourth part, with Marburg; Philip, an eighth part, with Rheinfels; and George, an eighth part, with Darmstadt. The death of Philip and Louis left all the Hessian dominions in the two main lines of Hesse-Cassel and Hesse-Darmstadt. See Hesse (grand duchy); Hesse-Cassel.

HESSE. A grand duchy of Germany, the eighth German State in size, lying between latitudes 49° 24′ and 50° 50′ N. and longitudes 7° 51′ and 9° 39′ E., consisting of two main divisions and eleven small exclaves. The northern main division, called the Province of Upper Hesse (*Oberhessen*), lies in the Prussian Province of Hesse-Nassau, and the southern between Prussia, Bavaria, Baden, and the Bavarian Palatinate (Map: Germany, C 4). Area, 2965 square miles. The Rhine traverses for about 55 miles the southern division of the duchy, which consists of the provinces of Rhine-Hesse and Starkenburg. Five of the exclaves border on, or are inclosed by, Baden and Württemberg. The remainder of the exclaves are within Prussian territory.

Physical Features and Climate. The surface consists of level, hilly, and mountainous sections. Upper Hesse is mountainous, and is identified with the basaltic Vogelsberg, situated in the east, and rising to a height of about 2500 feet. From this group radiate spurs and outliers west and north through the province, leaving in the south the Wetterau, an extensive, undulating, and arable tract of Upper Hesse. Into the southwestern part of the province extends the northern end of the Taunus, about 2000 feet high. The eastern half of Starkenburg is also mountainous, being occupied by the Odenwald Range, with four peaks reaching about 2300 feet—Krähberg, Hardberg, etc. The western part is in the Rhine valley proper, and in the north lies the low region bordering on the Main. Rhine-Hesse is mostly in the Rhine plain. The western part of this province consists of a rolling country of hills. The Hardt Mountains enter on the southwest, but their highest point (the Eichelberg) has an altitude of only about 1050 feet. The Rhine and the Main form the north border of the southern division of Hesse. The whole grand duchy, except the Vogelsberg district, belongs to the Rhine basin. The Neckar barely reaches Hesse on the south. Other Rhine tributaries from the right are the Lahn, the Weschnitz, and the Modau. On the left the Rhine receives the Selz and Nahe. To the Weser basin section of Upper Hesse belong the Fulda and the Schwalm.

The climate differs somewhat in the two main divisions of the duchy, being rather raw and cold in most of the northern part, while the southern division (except the Odenwald) and the Wetterau have the mild climate of Southern Germany. The mean annual temperature in Darmstadt is 49° F.—in summer 65°, in winter 29.7°; average rainfall, 33 inches. There are several mineral springs and salt-water baths in Hesse; namely, at Salzhausen, Bad Nauheim, etc.

Industries. The principal industry is agriculture, the soil being for the most part well adapted for farming. The land is divided into small holdings, as shown by the fact that out of the 133,840 holdings in the year 1895, over

59,000 contained less than 2½ acres each, and only about 9400 holdings contained over 25 acres each. Over 64 per cent. of the area is under cultivation. There is 31 per cent. in forest, more than one-third of which is State property. The forests constitute an important source of income-producing wealth. About one-half of the total area is arable, and one-eighth is in meadows and pastures. Rye, barley, wheat, and oats are cultivated. Hay and potatoes are produced in large quantities, and fruit is extensively grown. The cultivation of the vine, together with the production of fine wines, is a very important industry, not only in Rhine-Hesse, but on the slopes of the Odenwald. There were about 82,500 acres in sugar-beets and turnips in 1900. Agriculture is promoted actively by a Government board of agriculture at Darmstadt, by numerous associations, and excellent agricultural schools which instruct in all branches of farming, fruit-growing, etc. Fishing and hunting yield well commercially. Stock-raising as a separate industry can hardly be said to exist. In 1900 there were 59,091 horses, 330,679 cattle, 82,360 sheep, 124,790 goats, and 312,899 hogs.

The mining region of Hesse is found chiefly in the northern part, and produces coal, iron, and salt. In 1900 the mined minerals amounted to $474,000, and salt $125,000. The total of these products, together with those of the smelting-works and foundries, was about $2,525,000, the persons engaged numbering 3737. Peat is an important output, and Hainstadt-am-Main exports famous clays. The manufacturing industries are generally in a prosperous condition. Hesse is known for its manufactures of leather and leather goods. Other chief manufacturing products are tobacco and cigars, metal articles, paper, sugar, chemicals, spirits, etc. There were five sugar-factories in 1901. The province has many handicraft schools and courts of trade.

Commerce and Transportation. The trade of Hesse is of considerable importance, and is favored by many organizations and industrial banks, as well as by the central position of the grand duchy and the excellent transportation facilities. The exports consist mainly of agricultural and manufactured products; the chief imports are raw and half-finished materials. The river commerce is extensive, including much Belgian and Dutch trade. There are over 700 miles of railway, nearly all owned by Hesse, Prussia, and Baden.

Government and Finance. The government is that of a hereditary constitutional monarchy. The Grand Duke is very largely dependent on the civil list, which amounts to about $300.000. The Constitution was adopted in 1820, and has been repeatedly modified. The executive power lies in a responsible Ministry of three members, who are the heads of the departments of the Interior, Justice, and Finance. The Minister of the Interior is president of the Ministry, and is the Minister of Foreign Affairs and of the Ducal House. The legislative power is represented by two Chambers. The Upper Chamber is composed of all the princes of the reigning house, the heads of several noble families, the Roman Catholic bishop, a Protestant church dignitary, the chancellor of the University of Giessen, the representatives of the landed nobility, and not over twelve life members nominated by the Grand Duke. The Lower Chamber consists of ten members elected by the large municipalities and forty members returned by the small towns and rural communities. The members of the Lower Chamber are elected indirectly for six years. The Chambers meet each year. The three provinces are divided into eighteen circles. The provinces and circles have local councils elected by a restricted suffrage. The duchy is represented by three members in the German Bundesrat, and returns nine members to the Reichstag. The budget for 1901-02 was estimated at about $20,000,000. The chief items of revenue are from public domains, lottery, Imperial customs, and direct taxes. The chief articles of expenditure are for the Department of the Interior, lottery, service of the debt, and contributions of the Empire. The public debt amounted in 1901 to about $74,000,000, nearly all incurred for railways.

Population and Religion. The population was 992,883 in 1890 and 1,119,893 in 1900, showing an increase of nearly 13 per cent. for the decade. Hesse ranks seventh as to population among the German States. Number of inhabitants per square mile, 377.7. Emigrants are few. Darmstadt (q.v.) is the capital; the largest city, Mainz; other large towns are Offenbach and Worms. Over 65 per cent. of the inhabitants are Protestants. The Grand Duke is Protestant, and is the head of the Evangelical Church (embracing the Lutheran and the Reformed). It is governed by a synod and a consistory. The seat of the Roman Catholic bishop is at Mainz. The State contributes to both the leading faiths. This item was $120,000 in 1900.

Educational and Other Institutions. Education is free, compulsory, and maintained partly by the Government and partly by the communes. Secondary education was represented in 1900-01 by 29 gymnasia and 'real' schools, 5 high schools for girls, and 48 private schools. Advanced elementary schools—high schools and middle schools—numbered 34, and there were 902 'continuation schools' (*Fortbildungsschulen*), for scholars leaving the elementary schools. Higher education is supplied by the University of Giessen, and also by the Technical School of Darmstadt. The latter has about 1500 students. Both institutions are supported in part by the State. There are, in addition, not only the industrial schools, but numerous special institutions, as, for instance, a merchants' school and an ivory-carving school. The important libraries and museums number three each. Hesse has a State fire-insurance company, and institutions or pensions or insurance funds for all classes of needy, ill, or otherwise unfortunate persons, including indigent ladies of the nobility. In this respect Hesse is one of the most highly organized commonwealths in the world.

History. (See preceding article.) The line of Hesse-Darmstadt, the second main branch of the House of Hesse, is derived from George I., the fourth son of Philip the Magnanimous, Landgrave of Hesse, who, on the death of his father in 1567, obtained the Principality of Katzenelnbogen, with the town of Darmstadt for his residence, and received in 1583, on the death of his brother Philip without heirs, a third of the patrimony of the latter. (See **Hesse-Cassel.**) At his death, in 1596, he was succeeded in the greater part of his possessions by his eldest son, Louis V. (1596-1626), while another son, Frederick, became the founder of the Hesse-Homburg line. Louis V. acquired a portion of Upper Hesse, and is noted as the founder of the University of Giessen (1607). His son, George II. (1626-61), and grandson, Louis VI. (1661-78) did much to promote learning and the arts. Under Ernest Louis (1678-1739) the country was laid waste by the French armies. The finances became disorganized, and Louis VIII., who succeeded and ruled until 1768, did little to mend them. Louis IX. (1768-90) was a wise and able ruler, a patron of art and letters. As a result of the French Revolutionary wars, under Louis X. (1790-1830), Hesse-Darmstadt changed its boundaries materially, on the whole to its gain. Louis X. joined the Confederation of the Rhine in 1806, and assumed the title of Grand Duke as such (Louis I.). At the Congress of Vienna (1814-15) he was obliged to make large cessions of territory to Prussia and Bavaria, receiving, however, by way of indemnification, a large district on the Rhine, including the towns of Worms and Mainz, in right of which he assumed the traditional title of Rhenish Grand Duke. At this time Hesse-Darmstadt became a member of the German Confederation. In 1820 Louis promulgated a constitution establishing a parliamentary form of government. He instituted various reforms and joined the Zollverein (q.v.) in 1828. The reactionary policy of Louis II. (1830-48) evoked a strong opposition in the Landtag, but the Grand Duke finally succeeded in subordinating the Chambers to his will. The February Revolution of 1848 in France, however, lent renewed strength to the Liberal Party. In answer to the popular demand for constitutional reform, the heir to the throne was named co-regent with the King; Gagern, the great leader and apostle of German unity, was made Minister of the Interior; and a far-reaching programme of reform adopted, many features of which were carried out only to be abrogated in the reaction which followed the revolutionary wave of 1848-49. Louis III. succeeded his father in 1848. His chief adviser, Dalwigk, was a bitter enemy of Prussia, and in 1866 Hesse-Darmstadt sided with Austria against the former. The Grand Duke made a vain appeal to Napoleon III., of whom he was a personal friend, for assistance. The Hessians were defeated at Laufach, July 13th, and Prussian troops occupied the grand duchy. The Grand Duke was forced to cede some territory, including the recently acquired Hesse-Homburg, to pay a heavy war indemnity, to receive a garrison in Mainz, and to enter into an offensive and defensive alliance with Prussia. The Hessian troops played a conspicuous part in the war against France, and Hesse-Darmstadt became a part of the new German Empire. Louis IV. (1877-92) did much to restore the finances and increase the prosperity of the duchy. He was succeeded by his son, Ernest Louis.

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HESSE, hĕs′se, ADOLPH FRIEDRICH (1809-63). A German organist and musical composer, born at Breslau. He displayed such marked ability while studying piano, organ, and composition there, that the city fathers gave him financial assistance to continue his musical education at Weimar, where he was a pupil of Hummel, and also came under the influence of Rinck and Spohr. For the last thirty-two years of his life he was organist of Saint Bernard's Church, Breslau, directed the symphony concerts of the town, and made occasional professional tours to Paris, London, and elsewhere. Of his large variety of compositions, the most important are for the organ, and a complete edition of them was edited by Dr. Steggall.

HESSE, ĕs, ALEXANDRE (1806-79). A French historical painter, born in Paris. He was the pupil of his uncle, Auguste Hesse (1795-1869), an historical and religious painter of some note. He succeeded Ingres in the Institute (1867). His pictures are Venetian in coloring, and well composed. One of the more notable works is "Pisani's Triumph" (1847), in the Luxembourg.

HESSE, hĕs′se, OTTO (1811-74). A German mathematician. He was born in Königsberg, and studied and taught there from 1840 to 1856. After that he held professorships of mathematics, successively, at Halle, Heidelberg, and in the Polytechnic School at Munich. He was a disciple of Jacobi, and contributed chiefly to geometry and the theory of determinants. His important mathematical works include: *Vorlesungen über die analytische Geometrie des Raumes* (1861; 3d ed. 1876); *Vorlesungen aus der analytischen Geometrie der geraden Linie, des Punktes und des Kreises* (1865; 3d ed. 1881); *Vier Vorlesungen aus der analytischen Geometrie* (1866; completed in 1874); *Die Determinanten, elementar behandelt* (1871); *Die vier Species* (1872). A list of his memoirs may be found in the *Catalogue of Scientific Papers of the Royal Society of London*, vols. iii. and vii. The name of Hesse is connected with an important determinant form known as the Hessian, or Hessian covariant, which is of great value in the study of curved lines and surfaces. (See DETERMINANTS.) An edition of his works was published by the Bavarian Academy of Sciences (München, 1897). Consult Noether, "Otto Hesse," in the *Zeitschrift für Mathematik und Physik*, vol. xx. (Leipzig, 1875).

HESSE-CASSEL, or ELECTORAL HESSE (Ger. *Hessen-Kassel*, hĕs′sen kä′sel). A former landgraviate, later electorate, of Germany, forming at present the District of Cassel in the Prussian Province of Hesse-Nassau.

HISTORY. The House of Hesse-Cassel, representing the elder line of the House of Hesse, was founded by William IV., the Wise, the eldest of the four sons of Philip the Magnanimous (1509-67). (See HESSE.) William, who ruled as Landgrave from 1567 to 1592, was a good administrator, and left a well-consolidated little principality to his son Maurice, who resigned the government in 1627 to his son, William V., and died in retirement five years later.

William (1627-37) fought on the side of Sweden during the Thirty Years' War, for which he was put under the ban of the Empire. His two brothers, Hermann and Ernest, founded the lines of Hesse-Rothenburg and Hesse-Rheinfels. In 1637, on the death of William V., Amelia Elizabeth, his widow, assumed the regency for their young son, William VI., and ruled with vigor and ability. In the Peace of Westphalia (1648) the greater part of Schaumburg and the Principality of Hersfeld were acquired. William VI. died in 1663, and was succeeded by his sons, William VII. (1663-70) and Charles I. (1670-1730). The latter inaugurated the practice, continued by his successors, of hiring out Hessian soldiers to fight in the service of foreign princes, by which the finances of the State were considerably augmented at the expense of the welfare of the people. On the death of Charles, his son Frederick I., who in 1720 had become King of Sweden, in right of his wife, the Princess Ulrike Eleonore, sister of Charles XII., resigned the government of his Hessian territories to his brother William VIII., who succeeded him as Landgrave in 1751, and ruled until 1760. He fought under the British and Hanoverian flag in the Seven Years' War, and gained considerable military renown for himself and his troops. Frederick II. (1760-85) kept up a splendid court on the subsidies received from the British Government for the services of the Hessians who fought against the Americans in the War of Independence, and expended much of his treasures in the patronage of art and in the erection of public edifices. Frederick, who had become a convert to the Roman Church, was succeeded by William IX. (1785-1821), who reigned as William I. after his elevation to the rank of Elector in 1803. This prince frequently shifted sides during the French wars. In 1806, at the time of Prussia's struggle against Napoleon, he remained neutral, but Napoleon, nevertheless, seized his electorate, which was incorporated in the newly formed Kingdom of Westphalia (1807). In 1813, after the defeat of Napoleon at Leipzig, William returned to his dominions and began to restore the old order of things as far as he could, while he sought to recover the State lands that had been sold during his exile, and appealed so strongly for indemnification that he obtained various important concessions at the Congress of Vienna, although he failed to secure the title of King. In accordance with a promise which he had made on his restoration, he summoned a body of jurists to construct a constitution; but no sooner was the draft completed than he refused to abide by it. His death, in 1821, was regarded as a fortunate event. But his son and successor, William II. (1821-47), by his narrow policy, increased the rapidly growing disorders of the State, while his prodigality toward his mistress, the Countess of Reichenbach, rendered him peculiarly unpopular with his subjects. In 1831 William was compelled to promulgate a constitution. At the same time his son, Frederick William, was appointed co-regent. The history of the sixteen years' regency of Prince Frederick William exhibited a retrogressive policy, pursued at first under the guidance of Hassenpflug (q.v.), which left Hesse far behind other German States in material prosperity. The death of the old ruler occurred at Frankfort in 1847. The revolutionary movement of 1848 extorted from Frederick William I. (1847-66) many liberal promises of reform, some of which were redeemed; but in 1850, after revoking many of his pledges, he summoned again the obnoxious reactionist Hassenpflug to govern the country. The Elector and his Minister resorted to the most arbitrary measures to force the excited people to submission, and Hassenpflug persuaded the sovereign that his personal safety would be endangered if he remained longer among his subjects, and Prince and Minister fled from Cassel to Wilhelmsbad. Hassenpflug appealed for federal intervention, and Austrian and Bavarian troops entered the country. The friends of liberal government looked to Prussia for support. On November 2, 1850, a Prussian army entered Hesse-Cassel; but the Prussian King was timid, and the war was principally limited to angry protocols. External force was now applied to quell all opposition to the despotic sway of Frederick William, who in 1852 returned to Cassel. A new constitution was promulgated, which in no way satisfied the people, whose conduct throughout the trying crisis had been marked by forbearance and moderation. But the policy of the Government remained unchanged. Not until 1862, after much agitation and powerful pressure from Prussia, was the Prince forced to accede to the Constitution of 1831. After this concession, however, he still ruled in such a way as to paralyze the political activities of the country. In the Seven Weeks' War of 1866 Hesse-Cassel sided with Austria. A Prussian army entered the principality, June 16, 1866, and Frederick William was taken prisoner and conveyed to Stettin, where he remained till September 17th. Three days later Hesse-Cassel was incorporated with Prussia. The deposed Prince died January 6, 1875, leaving no direct heir.

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HESSE-DARMSTADT. See HESSE.

HESSE-HOMBURG, hôm'bo͝ork (Ger. *Hessen-Homburg*). Formerly a landgraviate, containing about 106 square miles, composed of the District of Homburg vor der Höhe on the right of the Rhine, and that of Meisenheim on the left. It has belonged to Prussia since 1866, and is now a part of Hesse-Nassau and of the Rhine Province. The landgraviate was an integral part of Hesse-Darmstadt till it was transferred in accordance with the disposition made by the Landgrave George I. (died 1596) to that Prince's youngest son, Frederick I., in 1622. It constituted a part of Hesse-Darmstadt from 1806 till the Congress of Vienna (1815), when its independence was restored and its territory augmented by the addition of Meisenheim. The opening of the springs and baths at Homburg in 1833 proved an unexpected source of wealth to the State, and after the addition of gambling saloons, the establishment constituted a very important branch of the revenue. Attempts were more than once made by the Diet to put down the gambling-tables; but whenever the pressure of Federal intervention was removed, gambling was always resumed with fresh spirit, and the system continued till 1872. In March, 1866, on the death, without heirs, of the last landgrave Ferdinand, who had succeeded his brother Gustavus Augustus, in 1848, the landgraviate fell to Hesse-Darmstadt, but remained united with that duchy only a few months, being ceded to Prussia on September 3, 1866.

HESSE-NASSAU, näs′sou (Ger. *Hessen-Nassau*). A province of Prussia, the southwestern part of the kingdom, lying between the Rhine and the Weser, and composed chiefly of the larger portions of Hesse-Cassel, Nassau, and Hesse-Homburg. It also contains the city of Frankfort (q.v.) (Map: Germany, C 3). The main body of the province is bordered by the Rhine Province, Westphalia, Waldeck, Hanover, and Prussian Saxony, Saxe-Weimar-Eisenach, Bavaria, and Hesse, and incloses the Hessian Province of Upper Hesse. Among the several exclaves that belong to Hesse-Nassau are the countship of Schaumburg and the Thuringian district in which Schmalkalden is situated. Area, 6000 square miles.

TOPOGRAPHY. The province is generally an elevated region. In the south are the rich valleys of the Main and Rhine; in the north lies the Weser Valley; but as a whole the province belongs to the mountain region of Middle Germany, and consists of high, rolling districts broken by peaks and rather prominent spurs and outliers. In the east are the Kaufunger Wald and portions of the Rhöngebirge, Vogelsberg, and Spessart. The Westerwald is in the west, and the important Taunus range in the extreme southwest. The western part of the province is traversed by the Lahn, an affluent of the Rhine. In the northeast are the Fulda and the Werra, which unite to form the Weser. The climate is mild and generally even.

INDUSTRIES. The principal occupations are agriculture and its allied industries. Of the total area, about 40 per cent. is under crops and gardens, about the same proportion is in forests, and the remainder is chiefly in meadow and pasture. Most of the land is distributed into small holdings. According to the industrial census of 1895 there were 212,349 holdings ranging from less than 5 acres to 50 acres, and 4743 holdings of over 50 acres each. The chief agricultural products are rye, wheat, potatoes, flax, oats, and hay (including clover and alfalfa). Tobacco and beans are cultivated to a considerable extent. Among the well-known wines of the province are the Johannisberger, Hochheimer, and Rüdesheimer. The forests are among the most extensive of Prussia, and belong mostly to the State and the communities. The trees are conifers, oaks, and beeches. The commercial yield of the forest is large. They abound in game, and the streams are rich in fish. Live-stock raising is not carried on extensively as a separate industry. In 1900 there were 85,170 horses, 587,802 cattle, 304,499 sheep, 556,233 swine, and 171,959 goats.

The mineral deposits are important, principally iron and coal. Of the former about 400,000 tons are obtained annually; of the latter, over 600,000 tons. Hesse-Nassau is one of the leading iron producers among the Prussian provinces. There are some deposits of zinc, lead, and copper. Good clay is found. The mineral springs and health resorts of the province are both numerous and famous, including those of Homburg, Wiesbaden, Ems, Schwalbach, and Selters. Several of the waters, especially the Selters, are exported extensively to all parts of the civilized world.

The manufacturing industries, with some exceptions, are on a small scale. The industrial census of 1895 gives the total number of establishments at 128,888, employing 344,502 hands. This number includes 58,664 establishments employing no help, and 42,865 establishments employing from one to five hands each. The chief manufactured products are cotton and woolen goods, tobacco, cigars, and sugar. Also worthy of mention are the exports of marble, dressed stone, and burnt clay, and wooden wares, leather, and jewelry. There were 347 distilleries in operation in 1901. The province has important fairs and markets, especially horse markets, and the trade and manufacturing interests are furthered by means of numerous chambers of commerce. The banks of Frankfort, the financial centre of this part of Germany, are celebrated for their strength and the extensive scope of their undertakings. The transportation facilities are fully adequate to the needs of the province. The railways are mostly controlled by the State. The splendid roads and natural waterways aid very materially in the distribution of products. The commerce is concentrated largely in Frankfort, Cassel, and Wiesbaden. Other important business towns are Hanau and Fulda.

GOVERNMENT AND EDUCATION. Administratively Hesse-Nassau is divided into the two districts of Cassel and Wiesbaden, subdivided into 24 and 18 circles, respectively. The former district is about twice the size of the latter, but has less population, Frankfort being included in the latter. Cassel (q.v.) is the capital. The province is represented in the Prussian Landtag by 26 Deputies in the Lower Chamber and by 21 members in the House of Lords. The highest educational institution is the University of Marburg, founded in 1527. There are an agricultural school at Weilburg, a farmers' association at Cassel, and an agriculture and forestry association at Wiesbaden. There are also several unions for bee and bird raising and gardening.

POPULATION. The population was 1,664,426 in 1890, and 1,897,981 in 1900, showing an increase of 14 per cent. for the decade. Population per square mile, 313.1. Emigrants, in 1900, 605. About 70 per cent. of the inhabitants are Protestant. For the history of Hesse-Nassau, see HESSE-CASSEL; HESSE-HOMBURG; NASSAU.

HESSE-WARTEGG, vär′tĕg, ERNST VON (1851—). An Austrian traveler, born in Vienna. His travels covered most of the habitable globe. He married Minnie Hauk, the opera singer, in 1881. He wrote, among many books of travel: *Prairiefahrten* (1878); *Tausend und ein Tag im Occident* (1896); *Chicago* (1892); *Curiosa aus der neuen Welt* (1893); *Korea* (1895); *China und Japan* (2d ed. 1900); *Schan-tung und Deutsch-China* (1898); *Siam* (1899); and *Samoa, Bismarckarchipel und Neuguinea* (1902).

HESSHU′SIUS, TILEMANN (1527-88). A German Lutheran theologian, born at Wesel, and educated at Wittenberg, Oxford, and Paris. From his post as lecturer of New Testament exegesis in Wittenberg, he went to Goslar (1553), then to Rostock (1556), to Heidelberg as professor of theology (1558), and then preached at Bremen, and (1560) at Magdeburg. But here, too, his love of strife and his extreme orthodoxy, and his absolute opposition to Crypto-Calvinism or to any form of Lutheranism less rugged than his own, brought him into trouble. He had to leave Magdeburg, and, driven from one town to another, settled at Neuburg in 1565 as Court preacher. From there he went to Jena, but in 1573 left Brunswick and became Bishop of Samland at Königsberg. Four years later he was forced to retire from this office, and became professor at Helmstedt. Hesshusius wrote: *Von Amt und Gewalt der Pfarrherren* (last ed., by Schütz, 1854); *De Cera Ecclesia et ejus Auctoritate* (1572); *Antidotum contra Dogma M. Flaccii, quod Peccatum Originis Sit Substantia* (1572); and *Assertatio Testamenti Christi* (1574). Consult: Wilkens, *Tilemann Hesshusius* (Leipzig, 1860); and Helmolt, *Tilemann Hesshus und seine sieben Exilia* (Leipzig, 1859).

HESSIAN FLY. A dipterous insect (*Cecidomyia destructor*), which, from the damage which the larva does to wheat in North America, and also to some extent in Europe, has become one of the most widely known of insects. It is dark in color, nearly black, with dusky wings and pale brown legs. While distinctively a wheat insect, it will breed also in barley and rye. Over a large part of the wheat area of the United States there are two principal broods, namely, a spring brood and a fall brood. There are, however, supplemental broods both in spring and fall, particularly in the southern wheat areas; but in the extreme northern area of the spring wheat belt there may be only a single generation. Each generation is represented by four distinct states, namely, egg, larva or 'maggot,' pupa or 'flaxseed,' and the mature winged insect. The eggs are very minute and slender, white in color, and are usually deposited in irregular rows of three to five or more on the upper surface of the leaf. Sometimes they are thrust beneath the sheaf of the leaf on the lower joints. The whitish maggots hatch and crawl down to the base of the sheath, developing on the substance of the stalk, causing a distortion or enlargement of the stalk at the point of attack. In a few weeks the larva contracts into a flaxseed-like object, which is the puparium. With the spring brood the insect remains in the flaxseed state during midsummer, giving out the perfect insect usually in September. With the fall brood, the insect passes the winter in the flaxseed state at the base of the winter wheat.

The best remedies are the late planting of winter wheat or the early planting of a narrow strip in which the flies will lay their eggs and which may afterwards be plowed under, the bulk of the crop being planted late. The copious and prompt use of fertilizers enables the wheat to tiller sufficiently to yield a partial crop even when badly attacked. The burning of the stubble, the destruction of volunteer wheat, and the growth of resistant varieties are all recommended.

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HES'TIA. See Vesta.

HES'TON AND ISLE'WORTH. A suburban municipality of London, England, on the Thames, 12 miles southwest of Saint Paul's (Map: London, E 4). Market gardening is carried on, and it is a favorite residential place of London merchants. Population, in 1891, 26,000; in 1901, 30,800.

HESYCHASTS, hĕs'ĭ-kăsts (from Gk. ἡσυχαστής, *hēsychastēs*, quietist, from ἡσυχάζειν, *hēsychazein*, to be quiet, from ἥσυχος, *hēsychos*, quiet). Mystics of the Greek Church, and particularly the monks of Mount Athos (q.v.). In all probability mysticism never entirely died out among the Oriental monastic bodies; but the mystics attracted an unusual share of attention, not only at home but in the Western Church, in the earlier half of the fourteenth century. A Basilian monk, named Barlaam (q.v.), in the course of a visit to the monasteries of Greece, observed several practices and doctrines which he considered reprehensible. The monks of Mount Athos especially provoked his reprobation and ridicule. Believing that in the soul lay a hidden divine light, which it was the office of contemplation to evoke, they withdrew at stated times to a retired place, seated themselves on the earth, and fixed their eyes steadfastly on the navel (whence the sobriquet by which they were known, ὀμφαλόψυχοι, navel-souls); and they averred that, after the allotted time of contemplation, a kind of heavenly light beamed forth upon them from the soul (whose seat, they held, was in that region), and filled them with ecstasy and supernatural delight. They declared that this light was the glory of God Himself, and they connected it in some unexplained way with the light which appeared at the transfiguration of the Lord. Barlaam denounced these notions as fanatical and superstitious. On the other hand, they were explained and defended by Gregory Palamas, the Archbishop of Thessalonica; and in order to settle the controversy, a council was held in Constantinople in 1341 which terminated in the triumph of Palamas and the monks. The controversy afterwards turned upon the nature of the light supposed to emanate from the soul in this state of contemplation. Other councils were called, one of which, in 1351, again pronounced in favor of the monks, through the influence, it was said, of the Court and of John Cantacuzenus, who was a patron of the Hesychasts. But the public voice was hostile to the sect, and on the retirement of their patron Cantacuzenus, who, in 1355, became a monk, they fell into obscurity. Consult: Stein, *Studien über die Hesychasten des XIV. Jahrhunderts* (Vienna, 1874); Holl, *Enthusiasmus und Bussgewalt bei dem griechischen Mönchtum* (Leipzig, 1898).

HESYCHIUS, hē-sĭk'ĭ-ŭs (Lat., from Gk. Ἡσύχιος). A Greek grammarian of Alexandria, probably belonging to the fifth century A.D. He was the author of a Greek lexicon taken partly from earlier works of a similar character, with the addition of new words and examples from the writings of poets, orators, historians, and physicians. Its value is very great, as it helps us to the correct readings in many texts, and contains no little information concerning the Greek dialects. The best edition is that of Schmidt (4 vols., Jena, 1858-68).

HESYCHIUS. According to Jerome, publisher of an edition of the New Testament, and also a revision of the Septuagint. He is generally identified with a Hesychius said by Eusebius to have been Bishop of Alexandria, and to have died a martyr during the Galerian persecution, about 311.

HESYCHIUS OF MILE'TUS (fl. probably c.550 A.D.). A Greek chronicler, surnamed The Illustrious (ὁ Ἰλλούστριος). We hear of three works of his: (1) A universal history in six books, beginning with the Assyrian King Belus, and coming down to the reign of the Byzantine Emperor Anastasius (518), of which a part of the sixth book, covering the history of Constantinople from the earliest times to the reign of Constantine (324), has been preserved under the title Πάτρια Κωνσταντινουπόλεως. (2) A history of the reign of Justin (518-527) and the earlier years of Justinian (527-565), now lost. (3) A biographical dictionary of Greek writers (Ὀνοματολόγος ἢ πίναξ τῶν ἐν παιδείᾳ ὀνομαστῶν), which was extensively excerpted by Photius and Suidas (qq.v.). The fragments of his works are collected by Müller, *Fragmenta Historicorum Græcorum*, iv. (Paris, 1841-70). An attempt to 'recover' Hesychius from Suidas and other excerpters has been made by Flach, *Hesychii Milesii Onomatologi quæ Supersunt* (Leipzig, 1882).

HETÆ'RÆ (Neo-Lat., from Gk. ἑταίρα, *hetaira*, fem. of ἑταῖρος, *hetairos*, comrade, companion; connected with ἔτης, *hetēs*, kinsman). In ancient Greek society women of more or less unconventional life. They were apt to be slaves or foreigners, and, skillful in dance or music, gave private or public entertainments. As, under the Athenian law, only a citizen's daughter could marry a citizen, many of these women, often of otherwise excellent character, were constrained, if they desired companionship, to accept concubinage. Some—for example, Aspasia, the instructor of Socrates and the friend of Pericles—were highly accomplished, and exerted great and wholesome influence upon State policy. Others, like Leontium, Phryne, Thais, and Theodota, while possessed of personal grace and charm, and more or less intellectual distinction, were more properly courtesans. The various words for women of irregular life should be sharply distinguished. *Hetæra*, like *concubina*, implies fidelity to a single man, and such relation may well have been a true marriage. *Meretrix*, *pornē*, and *scortum* signify a quite different thing—the harlot or prostitute. There was still another class represented by the words *pallakē*, *pallakis*, and *pellex*, signifying a mistress kept by a man already married. In the New Attic comedy the hetæræ are a conspicuous feature of the plot, and the *Letters* of Alciphron find in this their source, as do also Lucian's *Conversations of Hetæræ*.

HETÆRIA PHILIKE, hĕt'ȧ-rē'ȧ fė-lē'kė (Gk. ἑταιρία φιλική). A secret society of Greek sympathizers, founded in 1814, to liberate Greece from Turkish rule. Under the leadership of Prince Alexander Ypsilanti it brought about the Greek War of Independence in 1821.

HETCHEL. See HECKLE.

HET'EROCŒ'LA (Neo-Lat. nom. pl., from Gk. ἕτερος, *heteros*, other + κοῖλος, *koilos*, hollow). One of the two orders of calcareous sponges, including those in which the endoderm is composed of flagellate collared cells. In the other order, Homocœla, collared cells are restricted to flagellate chambers, and flattened cells compose the remainder of the endoderm. See SPONGE.

HET'EROCYST (from Gk. ἕτερος, *heteros*, other + κύστις, *kystis*, bag). A term applied to certain cells, empty or with watery contents, found in the filaments of blue-green algæ. See ALGÆ and CYANOPHYCEÆ.

HET'EROG'AMY (from Gk. ἕτερος, *heteros*, other + γάμος, *gamos*, marriage). A condition in plants, contrasted with isogamy (q.v.), in which the pairing sex-cells (gametes) are differentiated into sperms and eggs. Most plants are heterogamous in this sense. The term is also used when two kinds of flowers exist on the same plant; as, for example, in certain Compositæ, where the development of stamens and pistils differs in the disk and the ray flowers. See FERTILIZATION.

HET'EROGEN'ESIS (Neo-Lat., from Gk. ἕτερος, *heteros*, other + γένεσις, *genesis*, generation, from γίγνεσθαι, *gignesthai*, Skt. *jan*, to be born). A term bearing various meanings and relations. (1) The equivalent of abiogenesis or spontaneous generation. (See BIOGENESIS.) (2) A mode of reproduction in which the parent produces offspring unlike itself, as opposed to *homogenesis*, or the production of offspring like the parent or parents. See ALTERNATION OF GENERATIONS.

HET'EROG'ONY. See PARTHENOGENESIS.

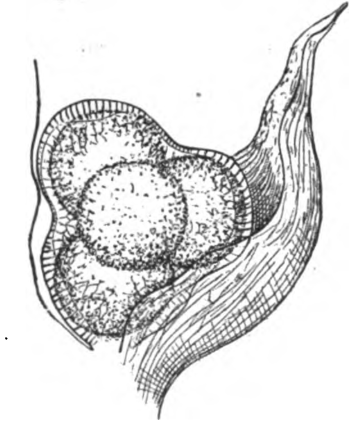
HET'EROPHO'RIA (Neo-Lat., from Gk. ἕτερος, *heteros*, other + -φορία, *-phoria*, carriage, from φέρειν, *pherein*, to carry), or INSUFFICIENCY. A condition in which the eyes are only prevented from deviating by constant muscular effort. Exophoria is the term applied to the tendency of an eye to look outward while the other is fixed upon an object; esophoria, to the tendency to deviate inward. The trouble is due to relative weakness of an eye-muscle, the result of some error of refraction or in persons generally run down. In severe cases there are headache, pain in the eyes, occasional double vision, blurring of point, and irritability of the eyelids. The difficulty is treated by attention to the general health and correction of errors of refraction by eyeglasses. Exercise of the weak eye-muscles is also employed.

HET'EROPH'YLLY (from Gk. ἕτερος, *heteros*, other + φύλλον, *phyllon*, leaf). That condition in which there are two or more forms of leaf on the same plant, a condition particularly well shown in amphibious plants in which the water leaf is finely divided, but the air leaf is entire and compact. See LEAF.

HET'EROP'ODA (Neo-Lat. nom. pl., from Gk. ἑτερόπους, *heteropous*, having uneven feet, from ἕτερος, *heteros*, other + πούς, *pous*, foot). A suborder of small pelagic pectinibranchiate Gastropoda (q.v.). They swarm at night at the surface of the ocean and swim rapidly about with their backs downward and their ventral surfaces uppermost. Their bodies are small, delicate, and often transparent, with well-demarcated heads, and well-developed sense, circulatory, breathing, and reproductive organs. The foot is compressed to form peculiar blade-like swimming organs. Most heteropods are naked, but some genera, among them Atlanta, Carinaria, and Oxygyrus, have delicate involute shells. These resemble in some respects those of certain fossil Bellerophons of Paleozoic age, and the resemblance has led many authors to include the Bellerophontidæ with the Heteropoda in spite of their larger size, and heavier and thicker shells. See BELLEROPHON; GASTROPODA.

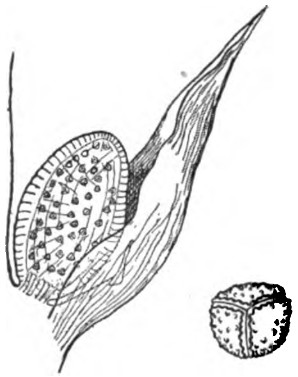
HET'EROP'TERA (from Gk. ἕτερος, *heteros*, other + πτερόν, *pteron*, wing). A suborder of the Hemiptera, including the 'true' bugs, characterized by dissimilarity in the wings. The proximal half of the anterior pair of wings is thickened, much like those of beetles. The suborder includes a number of aquatic forms, some of which occur out at sea hundreds of miles from land. The water-boatman (*Corixa undulata*), with a pair of oar-like legs, the large water-bug or 'electric-light bug' (*Belostoma Americanum*), and the long-legged water-striders are, perhaps, the best known of the aquatic forms. The bedbug, redbug, chinch-bug, squash-bug, and stink-bugs (qq.v.) are other familiar and important Heteroptera. See HEMIPTERA; HOMOPTERA.

HET'EROS'PORY (from Gk. ἕτερος, *heteros*, other + σπόρος, *sporos*, seed). The production, by plants, of two kinds of sexless spores. Heterospory is one of the most important phenomena in connection with the evolution of the plant kingdom, since through it the seed has appeared, and since a clear conception of flowering plants is impossible without some knowledge of the beginnings of heterospory. The phenomenon appears first, and in its simplest form, among certain of the fern-plants (Pteridophytes), and is universal among the seed-plants (spermatophytes). To understand the significance of heterospory it will be necessary to read the article on ALTERNATION OF GENERATIONS, since this deals with the two kinds of spores produced by the sexless generation (sporophyte).



HETEROSPORY.
Megasporangium of a club-moss containing four megaspores.

In ordinary ferns the spores are alike, and in germination each one produces a sexual plant (gametophyte), which bears both the male and the female sex organs. Such a condition is called 'homospory' (q.v.) or 'isospory,' which means in each case 'spores similar.' Very gradually the spores begin to differ in size, until presently some become very much larger than others. The large spores are called 'megaspores' and the small ones 'microspores.' More important than the fact of difference in size, however, is the other fact that the microspores produce sexual plants which bear only male organs, and the megaspores sexual plants which bear only female organs. There is a very definite relation between the amount of nutrition and the appearance of the female organs, so that the larger and hence better-nourished spore is expected to produce a female plant. In consequence of heterospory, therefore, the sexual plants become distinctly male and female. The unfortunate thing is that the sexual character has often been applied to the microspores and the megaspores, which are simply the sexless spores of a sporophyte, which necessarily produce gametophytes.



HETEROSPORY.
Microsporangium of a club-moss containing numerous microspores.

When spores become thus differentiated in size and in product, the spore-cases (sporangia) are also differentiated, so that certain sporangia produce only microspores, and others produce only megaspores. The former were naturally called 'microsporangia' and the latter 'megasporangia.' These sporangia are ordinarily produced upon leaf-like structures, and later the leaves bearing sporangia become differentiated in the same way, so that certain leaves bear only microsporangia and other leaves only megasporangia. Naturally the former were called 'microsporophylls' and the latter 'megasporophylls.' These names are used in connection with those fern-plants which are heterosporous, as the water-ferns, the little club-mosses (Selaginella), and the quillworts (Isoetes). Among the seed-plants (flowering plants), however, the corresponding structures already possessed names long in use, and not to be discarded. It is important, however, to know the structures among the seed-plants that correspond to those among the heterosporous fern-plants. It is found that the stamen (q.v.) of a flowering plant is a microsporophyll, that its pollen-sacs are microsporangia, and that the pollen-grain is a miscrospore. The interesting conclusion is reached, therefore, that the pollen-grain is a sexless spore, a conclusion quite contrary to the general impression that it is a male cell, and that the stamen is a male organ. It is found that the carpel (q.v.) of a flowering plant, which organizes the ovary, style, and stigma, is a megasporophyll; that the ovules are megasporangia; and that the so-called embryo-sac is a single large unshed megaspore. It follows, therefore, that the ovule is by no means the egg or ovule structure which its name would imply, but the spore-case (sporangium) of a sexless plant.

An important further fact in connection with heterospory is that upon its development the sexual plants (gametophytes) become very much reduced in size, for the most part not escaping from within the spores which produce them. As a consequence, the male plant or generation in a flowering plant is contained entirely within the pollen-grain; and the female plant or generation is completely inclosed within the ovule. For further development of the subject in connection with the evolution of the seed, see Seed.

HET′MAN. See Ataman.

HETTINGER, hĕt′tĭng-ẽr, Franz (1819-90). A German Catholic theologian, born at Aschaffenburg, and educated at Würzburg and at the German College in Rome. In 1847 he returned to Würzburg as assistant in the theological seminary, and nine years afterwards he became professor in the university. Hettinger wrote: *Apologie des Christentums* (8th ed. 1899-1900); *Lehrbuch der Fundamentaltheologie* (2d ed. 1888); *Timotheus. Briefe an einen jungen Theologen;* and many studies on Dante, of which the most important is *Die göttliche Komödie nach ihrem wesentlichen Inhalt und Charakter dargestellt* (2d ed. 1889). Consult the biography by Kaufmann (Frankfurt, 1891).

HETTNER, hĕt′nẽr, Alfred (1859—). A German geographer, son of Hermann Hettner. He was born at Dresden, studied at Halle, Bonn, and Strassburg, and was professor of geography at Leipzig, Tübingen, and Heidelberg. He made two expeditions to South America — to Colombia (1882) and to Peru and Bolivia (1888)—and in 1895 became an editor of the *Geographische Zeitschrift,* for which he wrote on anthropology and geographical methodology. He published: *Gebirgsbau und Oberflächengestalt der Sächsischen Schweiz* (1887): *Reisen in den colombianischen Anden* (1888); *Die Cordillere von Bogota* (1892); and the text in Spamer's *Atlas* (1896, 2d ed. 1900).

HETTNER, Hermann Theodor (1821-82). A German literary and art critic, born at Leisersdorf (Silesia). He had traveled extensively and become known through various volumes on literary and critical subjects before he was made professor of æsthetics at the University of Jena (1851). Afterwards he became director of the cabinet of antiquities in Dresden (1855), and professor of the history of art in the Academy of Fine Arts. In 1868 he was appointed director of the Historical Museum. His most important work is *Litteraturgeschichte des achtzehnten Jahrhunderts* (1856-70; parts 1 and 2, 5th ed. 1894; part 3, 4th ed. 1893-94). He also wrote *Die romantische Schule in ihrem innern Zusammenhange mit Goethe und Schiller* (1850); *Griechische Reiseskizzen* (1853); *Das königliche Museum der Gipsabgüsse zu Dresden* (4th ed. 1881); and *Italienische Studien: Zur Geschichte der Renaissance* (1879).

HET′TON. A town in the County of Durham, England, five and one-half miles northeast of Durham (Map: England, E 2). The mining of extensive coal deposits in the vicinity constitutes its principal industry. Population, in 1891, 12,700; in 1901, 13,670.

HETZEL, ȧ′tsĕl′, Pierre Jules (1814-86). A French publisher and littérateur, born at Chartres. From 1835 he was associated with Paulin, the French publisher, and afterwards took part in politics as a Republican. After the Revolution of 1848 he was chief of a department in the Ministry of Foreign Affairs and Secretary-General of the Provisional Government. After the coup d'état he was exiled and lived in Brussels until the amnesty of 1859. During the time he published a series of French classics. Upon his return to France he published, among other volumes, the romances of Jules Verne. He had founded, with M. J. Macé, a *Magasin d'éducation et de récréation* (1854), which was very successful, and his best claim to general interest, although his stories for children have always been popular. Under the pseudonym of P. J. Stahl he wrote *Les nouvelles et seules aventures de Tom Pouce* (1843); *L'esprit des femmes, et les femmes d'esprit* (1855); and other volumes.

HETZER, hĕts′ẽr, Ludwig. See Hätzer, Ludwig.

HEUBERGER, hoi′bĕrg-ẽr, Richard (1850—). An Austrian composer, born at Gratz. By profession a civil engineer, he did not take up music seriously until 1876. Two years later he became conductor of the Vienna Singakademie. He composed much instrumental music, and the operas *Abenteuer einer Neujahrsnacht* (1886); *Manuel Venegas* (1889), which was rewritten as the grand opera *Mirjam, oder das Maifest* (1894); and several ballets and operettas.

HEUBNER, hoib′nẽr, Otto (1843—). A German physician, born at Mühltroff, son of the revolutionist Otto Leonhard Heubner (1812-93). The son studied at Leipzig and Vienna, was long connected with the former university, and in 1894 went to Berlin as professor and manager of the clinic for children. Among his writings are: *Die luetische Erkrankung der Hirnarterien* (1874); *Die experimentelle Diphtherie* (1883, which received the prize offered by the Empress Augusta); *Klinische Studien über die Behandlung der Diphtherie mit dem Behringschen Heilserum* (1895); and *Syphilis im Kindesalter* (1896).

HEUCHERA, hū′kē-rȧ. See Alum Root.

HEUGLIN, hoi′glĭn, Theodor von (1824-76). A German traveler and ornithologist, born at Hirschlanden, Württemberg. From 1850 to 1865 he spent most of his time in Africa. While attached to the Austrian consulate at Khartum, he visited Dongola and Abyssinia, and afterwards described his travels in a volume entitled *Reisen in Nordostafrika* (1857). Next he visited the White Nile, the Sudan, and the west coast of the Red Sea, and in 1861 set out with a party for the interior of Africa to determine the fate of the explorer Eduard Vogel. After other expeditions he returned to Europe with rare collections, and published several valuable scientific works, including: *Ornithologie Nordostafrikas* (1869-75), and *Reise in das Gebiet der westlichen Zuflüsse des weissen Nil* (1869). Journeys which he made in 1870 and 1871 to Spitzenberg and Nova Zembla he described in *Reisen nach dem Nordpolarmeere* (1872-74).

HEUMANN, hoi′mȧn, Christoph August (1681-1764). A German scholar. He was born at Allstedt, studied at Jena, and in 1717 became head of the academy at Göttingen. He contributed largely to the growth of this school and to its change to a university. In the university he was made professor of the history of literature (1734), and of theology (1745). His great works, *Acta Philosophorum* (last ed. 1717-24), and *Conspectus Respublicæ Literariæ* (last ed. 1791-97), by the use of the analytical system, founded modern German literary history. He also translated, with a commentary, the New Testament (1750-63). Consult the life by Cassius (Cassel, 1768).

HEUMANN VON TEUTSCHENBRUNN, fôn toit′shen-brōōn, JOHANN (1711-60). A German jurist and writer on diplomacy, born at Muggendorf in Bavaria, and educated at Altdorf, where in 1740 he became professor. The first jurist to approach the study of diplomacy in a scientific manner, he wrote: *Commentarii de Re Diplomatica Imperatorum ac Regum Germaniæ* (1745-53); *Exercitationes Juris Universi* (1749-57); *Initia Juris Politiæ Germaniæ* (1757); and *Geist der Gesetze der Deutschen* (1761).

HEUN, hoin, KARL GOTTLIEB SAMUEL (1771-1854). A German novelist, known under the pseudonym H. Clauren, born at Dobrilugk, and educated at Leipzig and Göttingen. He became in 1792 secretary in the departments of Mining and Foundries in Westphalia, but he left the Prussian service in 1801 to become manager of an estate near Posen. Ten years later he returned to Berlin, received a place in a bureau of the Chancellor Hardenberg, and in 1820 became editor of the *Preussische Staatszeitung.* Heun is best known by the first line of a poem on the War of Liberation, *Der König rief, und alle, alle kamen,* which has become proverbial. His novels, realistic but full of false sentiment and of doubtful morality, are no longer read in Germany. They include: *Erzählungen* (1819-20); *Die graue Stube,* and *Mimili* (1824); and *Scherz und Ernst* (1820-28). Heun also wrote some dramas, which were collected, *Lustspiele* (2d ed. 1827). A collection of all his works appeared at Leipzig in twenty-five volumes (1851).

HEVEA, hē′vē-ȧ. A genus of about ten species of trees, natives of tropical South America, of the natural order Euphorbiaceæ, characterized by trifoliate leaves, loose panicles or corollaless flowers, and a trivalved capsular fruit. The species, especially *Hevea Braziliensis,* furnish the highest grade of South American india-rubber. The seeds are eaten by birds, but are considered poisonous to man and other animals unless boiled, a process which makes them edible.

HEVE′LIUS, HEVEL, hā′vĕl, or **HEWELKE,** hā-vĕl′ke, JOHANNES (1611-87). One of the most celebrated astronomers of the seventeenth century. He was born and died at Danzig. In 1641 he erected an observatory in his own house, furnished it with large telescopes constructed by himself, and devoted himself to astronomical observations. He was the first astronomer, with the exception of Gassendi, to observe a transit of Mercury (Gassendi's observation was made in 1631, that of Hevelius in 1661); and it is now generally conceded that he ranks next to Flamsteed among the astronomers of his day. Toward the end of his life he opposed the notion of using telescopic sights for astronomical instruments of precision, believing that the old method of observing through pin-holes, etc., was superior. Halley (q.v.) was at one time sent to Danzig by the Royal Society of London to examine into this question, and the controversy was decided against him. Hevelius's observatory and library perished by fire in 1679. His extant works include the following: *Selenographia, seu Descriptio Lunæ* (1647); *De Natura Saturni* (1656); *Cometographia* (1668); *Machina Cœlestis* (1673); *Prodromus Astronomiæ* (1690). His letters were published in 1683. Consult Seidemann, *Johannes Hevelius* (Zittau, 1864).

HEVESI, hĕ′vĕ-shē, LUDWIG (1843—). A German-Hungarian journalist and humorist, sometimes writing under the pseudonym of *Onkel Tom.* He was born at Heves, studied classical philology and medicine at Vienna, and entered journalism in 1865. In the following year he became one of the editors of the *Pester Lloyd;* then helped launch the Hungarian journal *Borsszem Jankó;* from 1871 to 1874 edited the Vienna juvenile *Kleine Leute;* and in 1875 became the art and dramatic critic of the *Fremdenblatt.* He writes mainly in German. His works include the humorous sketches of travel and collections of stories: *Sie sollen ihn nicht haben* (1871); *Des Schneidergesellen Andreas Jelky Abenteuer in vier Weltteilen* (1875); *Auf der Sonnenseite* (1886); *Buch der Laune* (1890); *Ein englischer September* (1891); *Regenbogen* (1892); *Von Kalau bis Säkkingen* (1893); *Glückliche Reisen* (1895); *Die Althofleute* (1897); *Blaue Fernen, neue Reisebilder* (1897); *Das bunte Buch. Humoresken* (1898); *Wiener Totentanz* (1899); *Der zerbrochene Franz nebst andern Humoresken* (1900); and *MacEck's sonderbare Reisen* (1901); the biographies, *Zerline Gabillon* (1894) and *Wilhelm Junker* (1896); and in Hungarian, *Karczképek* (1876), descriptive of life in Budapest.

HEWES, hūz, JOSEPH (1730-79). A signer of the Declaration of Independence, born at Kingston, N. J. He was educated at Princeton, and then went to Philadelphia, where he engaged in business. About 1760 he settled in Edenton, N. C., and was soon afterwards elected to the Legislative Assembly. In 1774 he was elected to the Continental Congress, of which, with the exception of a brief period when he declined to serve, he continued a member until his death, signing the Declaration of Independence in 1776.

HEWIT, hū′ĭt, AUGUSTINE FRANCIS (1820-97). An American Roman Catholic clergyman, superior of the Paulist Fathers. He was born in Connecticut, the son of Nathaniel Hewit, and was baptized as Nathaniel Augustus. He graduated at Amherst in 1839; entered the Congregational ministry in 1842, but a year later joined the Episcopal Church. In 1846 he was received into the Roman Catholic Church, and in 1850 entered the Redemptorists. He joined Fathers Hecker, Walworth, and other members of that Order in founding, in 1858, the Congregation of Saint Paul the Apostle, and was made professor of theology, philosophy, and Holy Scriptures in their seminary. On the death of Father Hecker he became superior of the Paulists. He edited the *Catholic World* (1869-74), and was a regular contributor to the *American Catholic Quarterly Review.* Among his works are: *Reasons for Submitting to the Catholic Church* (1846); *Problems of the Age* (1868); and *The King's Highway, or the Catholic Church the Way of Salvation* (1874)

He received the degree of D.D. from Amherst College in 1874.

HEW'ITSON, William Chapman (1806-78). An English naturalist, born at Newcastle-upon-Tyne. He practiced land-surveying until a bequest from a deceased relative gave him the means and the leisure to study the natural sciences. He gave great attention first to the Coleoptera and Lepidoptera of Great Britain, then to the study of birds' eggs, and devoted the last years of his life to the diurnal Lepidoptera of the world, gradually forming a large and valuable collection which he left to the natural history section of the British Museum. His library was bequeathed to the Natural History Museum of Newcastle. He contributed many papers on entomology and ornithology to scientific journals, and published: *British Oölogy* (1833-42); *Colored Illustrations of the Eggs of British Birds* (1846); *The Genera of Diurnal Lepidoptera* (1846), with E. Doubleday; *Illustrations of Diurnal Lepidoptera* (1863-78); *Illustrations of New Species of Exotic Butterflies* (1851-76); *Descriptions of One Hundred New Species of Hesperidæ* (1867); *Descriptions of Some New Species of Lycænidæ* (1868); *Equatorial Lepidoptera* (1869-70); *Bolivian Butterflies* (1874).

HEWITT, hū'ĭt, Abram Stevens (1822-1903). An American manufacturer and public man, born at Haverstraw, N. Y., and educated at Columbia College, where he was acting professor of mathematics in 1843. He studied law and was admitted to the bar in 1844, but defective eyesight prevented him from practicing, and he engaged in the manufacture of iron with Edward Cooper, the son of Peter Cooper, and a college classmate, who later became his brother-in-law. In 1862 Mr. Hewitt learned in England the process for making gun-barrel iron, and upon his retirement in 1876 as president of the American Institute of Mining Engineers, he delivered a widely read address upon *A Century of Mining and Metallurgy in the United States*. He served in Congress in 1871-79 and 1881-86, was chairman of the National Democratic Committee which directed the Tilden campaign in 1876, and was a Democratic member of the House committee which, in 1877, conferred with a similar committee from the Senate in regard to the choice of an electoral commission to settle the disputed Presidential election. In 1886 he was elected Mayor of New York City, defeating Henry George and Theodore Roosevelt. He was an earnest worker for good government and labored with much success for municipal reform. After his administration of two years he remained closely identified with municipal movements, and for his services in furthering the rapid-transit plan in New York City he was awarded a gold medal by the New York Chamber of Commerce in 1901. As a public benefactor he gave great aid to numerous institutions, and the present educational prominence of Cooper Union, founded by his father-in-law in New York City, is due largely to his services as trustee and secretary. He was chosen chairman of the trustees of the Carnegie Institution at its organization in 1901.

HEWITT, John Napoleon Brinton (1859—). An American ethnologist and linguist. He was born on the Tuscarora reservation, near Niagara Falls, N. Y.; with some Tuscarora blood in his veins, he learned the language of that tribe while a child. He was educated in the public schools of Wilson and Lockport, and was successively farmer and journalist till 1879, when he was employed by the department of American ethnology in the Smithsonian Institution, where he devoted himself to Indian ethnology and the languages of the Tuscaroras and Iroquois.

HEW'LETT, Maurice Henry (1861—). An English novelist, born in London, and educated there. He was called to the bar in 1891, and in 1896 was made Keeper of the Land Revenue Records and Enrolments. Though he had written much previously, he gained his reputation in 1898 with a beautiful romance entitled *The Forest Lovers*. His other books include: *Earthwork Out of Tuscany* (1895); *The Masque of Dead Florentines* (1895); *Songs and Meditations* (1897); *Pan and the Young Shepherd* (1898); *Little Novels of Italy* (1899); *Richard Yea-and-Nay* (1900); and *New Canterbury Tales* (1901). In his first romance and in the short stories that followed, Mr. Hewlett has of all his contemporaries best interpreted the more elusive phases of mediæval thought and sentiment. He can write with great charm an historical romance having few or no historical characters, depending upon his truth to life and his intimate acquaintance with the period he seeks to produce. Nothing of their kind can be better than the short stories called "Madonna of the Peach-Tree" and "The Duchess of Nona," in *Little Novels of Italy*. Some of the stories of the *New Canterbury Tales* are also exquisite in sentiment and execution.

HEXACHORD, hĕks'ȧ-kôrd (from Gk. ἕξ, *hex*, six + χορδή, *chordē*, chord). A name given by the ancient Greeks, in their music, to the great sixth. In modern music, hexachord denotes the six diatonic degrees of which Guido formed his scale, better known by the six syllables, ut, re, mi, fa, sol, la, to which the scale was sung. See Gamut.

HEX'ACORAL'LA (Neo-Lat., from Gk. ἕξ, *hex*, six + κοράλλιον, *korallion*, coral). A subclass of zoantharian corals so named by Haeckel because the radiating septal walls of the polyps are arranged in series of six or multiples of six. Recent researches have shown that the Hexacoralla constitute an artificial group. See Coral.

HEX'ACTINEL'LIDA (Neo-Lat. nom. pl., from Gk. ἕξ, *hex*, six + ἀκτίς, *aktis*, ray). One of the two orders of siliceous sponges (see Sponge), comprising those with six-rayed siliceous spicules; they live at considerable depths and include the glass sponge (Euplectella) and other hyaline forms. The other order is Desmospongiæ, including "Silicispongiæ devoid of six-rayed spicules." The group is an ancient one, present in geological formations from the Ordovician down to present times. Remains attributed to this group occur in Precambrian rocks at Saint John, N. B.

HEX'AGON (Lat. *hexagonum*, from Gk. ἑξάγωνον, from ἕξ, *hex*, six, + γωνία, *gōnia*, angle). A geometric figure of six sides. When the sides and angles are respectively equal, the hexagon is said to be regular. If a regular hexagon is inscribed in a circle, each side is equal to the radius of the circle, and by joining the angular points to the centre of the circle six equilateral triangles are formed. Hence the perimeter of the circle may be divided into six equal parts by laying off in succession six chords, each equal to the radius. See POLYGON.

HEX'AGRAM (from Gk. *ἑξαγράμματος, hexagrammatos*, consisting of six letters, from *ἕξ, hex*, six + *γράμμα, gramma*, letter), MYSTIC. In 1639 Pascal, at the age of sixteen, published the proof of the proposition that the three pairs of opposite sides of a hexagon or *hexagramma mysticum*, as he termed it, inscribed in a conic, intersect in three collinear points. This is a fundamental proposition of modern geometry, and its reciprocal is Brianchon's theorem. See CONCURRENCE.

HEX'AHE'DRON (from Gk. *ἕξ, hex*, six + *ἕδρα, hedra*, base). A solid geometric figure of six faces. A regular hexahedron is called a cube. See CUBE; POLYHEDRON.

HEX'AM, LIZZIE. The heroine of the subplot in Dickens's *Our Mutual Friend*. She educates her ungrateful younger brother, frees her father's name from the stigma of murder, and is finally married to Eugene Wrayburn.

HEXAM'ETER (Lat., from Gk. *ἕξ, hex*, six + *μέτρον, metron*, measure). The name of a verse composed of six feet or measures. The name hexameter usually refers to the dactylic hexameter, the heroic or epic verse of the Greeks and Romans, the best examples of which are Homer's *Odyssey* and *Iliad* or Vergil's *Æneid*. The last part of every verse must be either a spondee (two long syllables, as in *anno*) or a trochee (a long and a short syllable, as in *qualis*), and the penultimate must be a dactyl (a long and two short syllables, as in *tĕgmĭnĕ*). The rest may be either dactyls or spondees. Thus constructed the verse is called dactylic. Homer offers a regular dactylic hexameter in the verse:

δεινὴ | δὲ κλαγ | γὴ γένετ' | ἀργυρε | οῖο βι | οῖο.

Vergil gives this example:

Tītyrĕ | tū pătŭ | læ rĕcŭ | bāns sŭb | tĕgmĭnĕ | fāgī.

The dactylic hexameter has often been employed in modern poetry, especially in English and in German. Thus, in Longfellow's *Evangeline*, we read these lines:

This is the | forest prim|eval. The | murmuring | pines and the | hemlocks
Bearded with | moss and with | garments green, indis|tinct in the | twilight,
Stand like | Druids of | old with | voices sad and pro | phetic,
Stand like | harpers | hoar with | beards that | rest on their | bosoms.

And Klopstock's *Messias* begins with the line:

Sing', un|sterbliche | Seele, der | sündigen | Menschheit Er | lösung.

The last line of the Spenserian stanza consists of an iambic hexameter. Thus:

And often knockt his brest, as one that did repent.

HEX'APLA (Gk. *ἑξαπλᾶ*, sixfold). The name given to the work compiled by Origen for the purpose of restoring the purity of the Septuagint text of the Bible and bringing it into closer agreement with the original Hebrew. (See BIBLE, heading *Versions*.) It consisted of a six-column text: (a) the Hebrew text; (b) the same text transliterated into Greek characters; and the Greek translations of (c) Aquila; (d) Symmachus; (e) the Septuagint; (f) Theodotion. In case of a number of books, Origen added comparisons with three other Greek translations. The omissions in the Septuagint were generally supplied from Theodotion and marked by an asterisk, while additions in the Septuagint, as compared with the Hebrew text, were indicated by an obelisk. In consequence, however, of the neglect of these distinguishing signs in manuscripts of the Hexapla, great confusion arose, so that it has been well nigh impossible to recover the original Septuagint text. The Hexapla, as a whole, has long been lost; several editions of those fragments which it has been possible to recover, have been printed; that by the Benedictine Montfauçon (2 vols., Paris, 1713), which retains, so far as it was retained in the manuscripts, the arrangement and even the asterisks and obelisks of Origen, long enjoyed high favor, but is now superseded by the admirable edition of Frederick Field (2 vols., Oxford, 1867-75), with additions and supplements by Pitra in *Analecta Sacra Spicilegio Solesmensi*, vol. iii. (Paris, 1883). See ORIGEN.

HEXAP'ODA (Neo-Lat. nom. pl., from Gk. *ἑξάπους*, having six feet, from *ἕξ, hex*, six + *πούς, pous*, foot). The name of a class of arthropods, the insects, equivalent to Insecta.

HEXATEUCH (from Gk. *ἕξ, hex*, six + *τεῦχος, teuchos*, implement, book). A term used to denote the first six books of the Bible, viz.: Genesis, Exodus, Leviticus, Numbers, Deuteronomy, and Joshua. While *Pentateuch* (q.v.) as a title of the five books ascribed to Moses, and *Octateuch* as a designation of these with Joshua, Judges, and Ruth, go back to antiquity, *Hexateuch* is a modern term that has come into vogue chiefly through Kuenen and Wellhausen. It represents a critical view, according to which the Book of Joshua was compiled from the same sources as the Pentateuch, and once formed with it a separate work. This opinion presupposes the conviction that the Pentateuch is not the work of Moses, but a later compilation from sources of different age, which sources also appear in the Book of Joshua. The existence of such sources is thought to be proved by duplicate accounts of the same events and marked differences of representation, which differences do not occur indiscriminately, but appear in well-defined sections and in combination, a given point of view and certain marked characteristics of language and style invariably being found together. The following sources are now generally recognized: (1) A prophetic narrative, itself a combination of two distinct sources, one using Jehovah (Yahweh) as the divine name and hence commonly called J, the other using Elohim as the name of God and hence called E, the combination being designated as JE. It presents a succession of more or less closely connected narratives, beginning with the creation and extending to the conquest of Canaan. (2) A priestly document (P), covering the same period, but distinguished by the combination of narrative with legal ordinances. It is often called the 'Priests' Code,' although the name strictly belongs only to the legislative portions (i.e. certain of the laws in Exodus and those of Leviticus and Numbers). (3) The code of laws known as the 'Book of the Covenant' (C; Ex. xxi-xxiii). (4) Another code, the 'Law of Holiness' (H; Lev. xvii.-xxvi.). (5) The Book of Deuteronomy (D; also containing certain codes). The work of combination is commonly referred to a 'redactor' designated by R. These sources are in turn generally considered as composite, or at least to have undergone successive revisions before being combined into the Hexateuch as we have it. There is difference of opinion concerning the minutiæ of the analysis, the age of the documents, and their relation to each other, and the process or processes by which they have reached their final form. But scholars do not now question the existence of such sources; and they are in substantial accord as to what they are in the main, as indicated above. That the Pentateuch contains post-Mosaic material was seen by some writers as early as the second century, such as Ptolemy the Gnostic, and the author of the Clementine Recognitions. It was shrewdly intimated by Ibn Ezra (died 1167). Through Carlstadt (1520), Du Maes (1574), Pereira (1594), Bonfrère (1625), Hobbes (1651), Peyrère (1655), Spinoza (1670), Simon (1678), and Le Clerc (1685), the facts showing a later authorship of the Pentateuch were brought out. In 1753 Astruc published his epoch-making conjectures as to the documents possibly used by Moses in the compilation of Genesis. He had correctly observed that sections in which Elohim was used as the divine name differed in vocabulary, style, and thought from sections in which the name Yahweh was used, and concluded that they belonged to different documents, though some fragments could not be ascribed to either of these. Before the end of the century Eichhorn (1780) and Ilgen (1798) had further developed the documentary theory, the latter distinguishing between two sources using the name Elohim and leaving it an open question whether there was more than one writer using the name Yahweh, while Geddes (1792-1800) had framed a theory based on the existence of unrelated fragments recognized by Astruc. This theory was introduced in Germany by Vater (1802), and found an exponent in De Wette (1806), whose view that the divine names represented not so much different authors as different ages or schools of religious thought was destined to exercise a wider influence. He also suggested that an earlier epic was supplemented in later times. This led to the supplementary theory championed by Ewald and Tuch (1830). While De Wette himself and Gesenius (1815) still regarded the bulk of the legislation in Exodus and Leviticus as earlier than Deuteronomy, which they placed in the Exile, George (1835) and Vatke (1835) were led partly by a careful analysis of customs and ideas, partly by applying Hegelian principles of historic development, to the conviction that this priestly legislation was later than Deuteronomy, thus anticipating the position now generally held. The reaction led by Ewald against a too mechanical construction of history according to philosophical categories, and in the direction of a stronger emphasis upon personality, brought Hexateuchal criticism back to the documentary theory, while delaying for a time the recognition of Israel's historic development divined by the disciples of De Wette and by Reuss. This scholar in 1850 expressed his conviction that the priestly legislation was later than Deuteronomy, but without a definite conception of the Pentateuchal documents. Hupfeld in 1853 carefully defined the main sources of Genesis, making the necessary distinction between the two writers using the name Elohim. A correct characterization of Deuteronomy was given by Riehm (1854). A clear idea of the Priests' Code could only be obtained after the historical criticism of Reimarus (whose *Wolfenbüttel Fragments* were published by Lessing in 1777) had been resumed by Colenso (1860) and Nöldeke (1869). Before Nöldeke's work had appeared it was still possible for Graf (1866) to give to the legislative portions a post-exilic date, while leaving the closely allied matter in the pre-Deuteronomic period. This error was corrected by Kuenen (1866). The position reached by Reuss, Graf, and Kuenen was ably defended by Wellhausen (1876). His comparison between the regulations as to sanctuaries, festivals, priestly functions, and revenues in the different codes and between these and the historic and prophetic books was especially convincing. Budde (1883) observed that there was an earlier stratum within the Yahwistic documents which did not know of a deluge. The history of Israel was written from the new standpoint by Stade (1886). Dillmann embodied the results of documentary analysis in his learned commentaries on the books of the Hexateuch (1886-92), though he was unwilling to accept the priority of Deuteronomy except as regards some late additions to the Priests' Code. During the last decade most scholars have come to recognize the essentially post-exilic origin of the Priests' Code. The Book of the Covenant is considered the oldest of the codes and perhaps of the sources. It probably dates from early in the ninth century, B.C. It is generally held that the earlier Elohistic narratives originated in North Israel before the fall of Samaria in B.C. 722. The Yahwistic narratives show a marked preference for Judean heroes, sanctuaries, and traditions; hence many scholars assign them to the Kingdom of Judah before the reign of Josiah; others think they originated in the northern kingdom, but have been worked over in Judah. It is agreed that both the Elohistic and the Yahwistic documents received various additions from time to time. They were combined in the seventh century B.C. The difference of opinion as to their relative age has lost much of its positiveness and importance by the fact that, in case of duplicates, the originality is seen to be sometimes on one side and sometimes on the other, and by the shifting of interest from the writers, who, after all, were chiefly collectors of stories, to the narrators who gave them a form and told them at the sanctuaries. It is especially Gunkel (1902) who has called attention to these aspects of the question. While Steuernagel has not won general recognition for his analysis of the Deuteronomic Code, it is commonly maintained that our present book has gone through at least two redactions, and this scholar has made it probable that the work introduced by Josiah as the law of Israel (see JOSIAH) had itself been compiled from smaller codes embodying decisions by elders, priestly oracles, and acknowledged rules of conduct. The code of Holiness is thought to belong to the time of Ezekiel (c.560 B.C.), and the combination of Deuteronomy and JE probably took place at about the same time. Most uncertainty still prevails in regard to the Priests' Code. While some scholars consider this code as having been introduced by Ezra and afterwards united with Deuteronomy and the earlier code-books (c.400 B.C.), others look upon the Code of Ezra as a compilation containing both the priestly documents and the previously existing ones. The general opinion is that the Priests' Code grew up in Babylon. Eduard Meyer regards Ezra as its author. But the unity of this book has long been questioned. Popper (1862) showed that Ex. xxxv.-xl. and Lev. viii.-x. are by a different hand from that which wrote Ex. xxv.-xxxi. Klostermann (1877) indicated a separate authorship for the Holiness Code (Lev. xvii.-xxvi.). Baentsch (1901) and Berthelot (1901) agree in regarding Lev. i.-vii. and Lev. xi.-xv. as independent minor codes. Graf (1871) and Maybaum (1880) suggested that the priestly writer was only a supplementer of the earlier text. Klostermann (1893) considered this writer as the editor of the Pentateuch. Schmidt (1902) also thinks that the so-called Priestly Document never existed as a separate code, but consists of a collection of laws, illustrative stories, annotations, and comments added to the already existing books by the priesthood in Jerusalem, chiefly during the Persian period. As the Book of Joshua has been subjected to a thorough priestly redaction, while the books of Judges, Samuel, and Kings have only been edited by men writing in the spirit of Deuteronomy, the question naturally arises why Joshua should have fared differently from the rest of the 'former prophets.' The answer generally given is that the Priestly Document ended with the conquest of Canaan, and that the Book of Joshua was cut off from the once existing Hexateuch. But Eduard Meyer is probably right in holding that there never was any Hexateuch, but that the Law, Joshua, Judges, Samuel, and Kings once formed one great historic work. This seems to have been essentially a Deuteronomistic work. The additions made in priestly circles affected some facts more than others. As the section dealing with events up to the death of Moses came to be regarded as 'the Law,' the rest formed a class by themselves. The division of the Law into five parts probably does not go back to the time when the Book of Joshua formed a part of the great work. The term Hexateuch is therefore likely to disappear, while the observations that led to its use are seen to be accurate, and the theory framed to account for them is recognized as essentially sound.

Bibliography. Consult the later commentaries on the books of the Hexateuch; the introductions to the Old Testament of Bleek-Wellhausen, Cornill, Driver, König, and Wildeboer; the Hebrew histories of Kittel and Piepenbring, which include discussions of literary sources; the article "Hexateuch" by Cheyne in the *Encyclopædia Biblia;* id., by Wood, in the Hastings *Dictionary of the Bible;* Westphal, *Les sources du Pentateuch* (Paris, 1888-1892); Kuenen, *The Hexateuch* (Eng. trans., London, 1886); Wellhausen, *Die Composition des Hexateuch* (Berlin, 1889); Robertson Smith, *The Old Testament in the Jewish Church* (2d ed., Edinburgh, 1892); Addis, *Documents of the Hexateuch* (London, 1892-98); Holzinger, *Einleitung in den Hexateuch* (Freiburg, 1893); Klostermann, *Beiträge zur Entstehungs-geschichte des Pentateuchs* (Leipzig, 1894); Battersley-Carpenter, *The Hexateuch* (London, 1900); Kautzsch, *Die heilige Schrift des Alten Testaments* (Freiburg, 1896; Eng. trans., New York, 1899), a clear and concise survey of the sacred literature of the Hebrews. For arguments in support of the traditional view, consult Green, *Moses and the Prophets* (New York, 1883); id., *The Hebrew Feasts* (ib., 1886); and the series of articles by Harper and Green in *Hebraica,* vols. v.-viii. (1886-92). See the articles upon the books of the Hexateuch; also Elohist and Yahwist; Ezra; Ezekiel; Pentateuch.

HEX'HAM. A market-town in Northumberland, England, on the Tyne, 20 miles west of Newcastle (Map: England, D 2). It has interesting remains of a splendid twelfth-century abbey church, erected on the site of a structure built by Saint Wilfrid about 675, the crypt of which was recently discovered. Hexham is the see of a Roman Catholic diocese. Coal and barytes are mined in the vicinity. The town was the scene of a Lancastrian defeat in 1464. Population, in 1891, 5900; in 1901, 7100. Consult: Raine, *The Priory of Hexham, Its Chroniclers, Endowments, and Annals,* Surtees Society (London, 1864-65); Hewitt, *Hexham and Its Antiquities* (Hexham, 1879).

HEY, hī, Julius (1832—). A German singing-teacher, important for his efforts to further Wagner's views on vocal training. He was born at Irmelshausen, and studied music under F. Schmitt and F. Lachner. He was introduced to Wagner by King Louis II., and, in connection with the Munich School of Music, attempted a revolution of the national system of singing. His attempts failed, and on Wagner's death, in 1883, he retired from public life to complete his work on singing, *Deutscher Gesangsunterricht* (1886). Although unsuccessful in his efforts to overturn the existing methods of voice culture, Hey exercised a powerful influence on the contemporary schools of singing.

HEY, Wilhelm (1790-1854). A German fabulist. He was born at Leina, was educated at Jena, and successively became pastor at Töttelstädt (1818), Court preacher at Gotha, and superintendent at Ichtershausen. His more famous works, issued anonymously, *Fünfzig Fabeln für Kinder* (1833), and *Noch fünfzig Fabeln* (1837), were followed by poems called *Erzählungen aus dem Leben Jesu* (1848). Consult Hansen, *Wilhelm Hey* (Gotha, 1886).

HEYDEBRAND UND DER LASA, hī'dĕ-brånt ųnt dĕr lä'zå, Tassilo von (1818-99). A German authority on chess, born at Potsdam. He was for a time German Ambassador to Copenhagen. The possessor of one of the largest libraries on chess in the world, he wrote the *Handbuch des Schachspieles,* which appeared under the name of Bilguer, and *Leitfaden für Schachspieler* (5th ed. 1880). With Frank he edited the old Portuguese work on the game by Damiano (1857).

HEYDEMANN, hī'de-mån, Heinrich (1842-89). A German archæologist. He was born at Greifswald, and studied at Tübingen, Bonn, Greifswald, and Berlin. His specialty, the study of vases, took him to Italy and Greece, and in 1869 he became instructor in archæology at the University of Berlin. Five years afterwards he went to Halle as professor of archæology. Most of his writing was for the journals, *Annali dell' Instituto, Archäologische Zeitung,* and *Zeitschrift für bildende Kunst.* Among his other works are: *Iliupersis* (1866); *Griechische Vasenbilder* (1870); *Die Vasensammlungen des Museo Nazionale zu Neapel* (1872); *Terrakotten* *aus dem Museo Nazionale zu Neapel* (1882); *Dionysos' Geburt und Kindheit* (1885); *Pariser Antiken* (1887).

HEYDEN, hī'den, Adolf (1838—). A German architect, born at Krefeld, pupil of Schlüter, in Berlin, where he worked at first independently, but after 1868 was associated with Walter Kyllmann in the erection of important structures there and in other cities of Germany. He also executed a great deal of decorative work, and strongly influenced the development of industrial art by his numerous designs in this branch.

HEYDEN, August von (1827-97). A German historical painter, born at Breslau, the son of Friedrich von Heyden, the poet. He studied mining in Breslau and Berlin, and had already become director of the various mining interests of the Duke of Ujest before taking up painting in 1859 at the Berlin Academy under Eduard Holbein. He then entered the studio of Steffeck and finished his studies under Gleyre and Couture in Paris, where his "Saint Barbara, Patron Saint of Miners," was awarded the gold medal in the Salon of 1863. Of several historical and numerous ideal compositions, the more important are: "The Meeting of Luther and Georg von Frundsberg at the Diet of Worms, 1521" (1866, Germanic Museum, Nuremberg); "The French Ambassadors Suing for the Hand of Princess Clémence" (1869); "Morning Festival" (1870, National Gallery, Berlin); "Ride of the Valkyries" (1872, owned by the German Emperor); and "The Rescue of Wittich" (1880, Karlsruhe Gallery). Besides two large mural paintings for the Hall of Assizes at Posen, representing episodes from local history, he executed decorative work in the city hall, the National Gallery, and other public buildings in Berlin, where he was professor of the history of costume from 1882 to 1893. He published: *Blätter für Kostümkunde* (2d ed. 1876-90): *Die Tracht der europäischen Kulturvölker* (1889); the miners' fairy tales, *Aus der Taufe* (1878), and *Die Perlen* (1881), illustrated by himself; *Aus eigenem Rechte der Kunst* (1894); and *Jury und Kunstausstellungen* (1894).

HEYDEN, Friedrich August von (1789-1851). A German poet, born at Nerfken, near Heilsberg, in East Prussia, and educated at Königsberg, Berlin, and Göttingen. He wrote some dramas, which are now forgotten, but was successful as a writer of poetic tales, the best known of which are: *Die Gallione* (1825); *Reginald* (1831); *Das Wort der Frau* (1843, 23d ed. 1881); *Der Schuster von Ispahan* (1850); and *Die Königsbraut* (1851).

HEYDEN, Jan van der (1637-1712). A Dutch landscape and architectural painter, born at Gorkum. His subjects are the exteriors of buildings, for which Adriaen van der Velde, Eglon van der Neer, and Lingelbach supplied the figures. He was a thorough master of perspective and combined an extraordinary degree of finish with great breadth of general treatment and warm, harmonious color. Characteristic works by him are: three street scenes, in the Amsterdam Museum; another street scene in The Hague Gallery; three fine examples in the Louvre (one of them a view of the Amsterdam Town Hall); a street in Cologne, and a view of Cologne Cathedral in the National Gallery, London. His pictures are always of small dimensions.

HEYDEN, Otto (1820-97). A German historical and portrait painter, born at Ducherow, Pomerania. He was a pupil of Wach and Kloeber at the Berlin Academy (from 1843), then of Cogniet in Paris (1847-48), and later continued his studies independently in Italy (1850-54). Although the bulk of his work is devoted to the delineation of national history, he also painted religious subjects, genre scenes, and landscapes, besides many portraits. From his sojourn in Italy dates "Job and His Friends" (Stettin Museum), followed after his return by "Foundation of Greifswald University, 1455" (1856, in the Aula of the University); "Duke Boguslav X. on His Pilgrimage to Jerusalem Attacked by Pirates, 1497" (Stettin Museum); "Field Marshal Schwerin in the Battle of Prague" (Royal Palace, Berlin). The Austro-Prussian War, in which he took part in the suite of Crown Prince Frederick William, brought "The Battlefield of Königgrätz" (1868, National Gallery, Berlin), and three episodes in the battle of Königgrätz, all owned by the German Emperor, and several reminiscences of the Franco-German War of 1870-71, in which he also accompanied the army. "Emperor William I. Visiting the Wounded in the National Gallery of Versailles," is especially noteworthy. A visit to the East in 1869 resulted in several genre and landscape scenes from the Nile, and for the Dankeskirche in Berlin he executed the mural paintings of "The Last Supper," "The Adoration of the Magi," and "The Resurrection" (1883).

HEYDRICH, hī'drĭk, Heinrich Moritz (1825-85). A German poet, born at Dresden and educated at Leipzig and at Berlin. His principal works are: The tragedies, *Tiberius Gracchus*, and *Leonore von Portugal* (1861); the farce *Prinz Lieschen* (1861); and a collection of poems, *Sonnenschein auf dunklem Pfade* (1869).

HEYDT, hit, August, Freiherr von der (1801-74). A Prussian administrator. He was born at Elberfeld, where with his two brothers he carried on the banking business founded by his father. Elected a Deputy in 1847 and a member of the National Assembly in 1848, in the latter year he became Minister of Trade. Three years afterwards he was made director of the Prussian Bank. His Cabinet post he held through the period of reaction, as his politics were not extreme. In 1862 he became Minister of Finance in the Hohenlohe-Itzenplitz Cabinet, and attempted to please both sides in the growing conflict between Crown and Legislature. He retired on Bismarck's assumption of control later in the year, but was recalled in 1866 to face the question of raising funds for the war with Austria, clashed with the Diet, but held his place until 1869.

HEYDUK, hī'dụk, Adolf (1835—). A Czechic poet, born at Reichenburg, and educated at Brünn and Prague. Since 1860 he has been professor in the Realschule at Pisek. He wrote a valuable sketch of Slavic and German mythology (1863), and the popular poems, mostly lyric, but many in the epic of idyllic manner: *Lesní kvíti* (1875); *Dřevorubec* (1882); *Cymbal a husle* (1876), which deals with the Slovaks; *Pisně* (1885);

Zavátě listy (1886); *Na vlnach* (1890); and *Bohatýři* (1894).

HEYER, hī'ẽr, Gustav (1826-83). A distinguished German forester, son of Karl Justus Heyer (q.v.). He was born at Giessen, and studied at the University of Giessen, where at the age of twenty-seven he became professor of forestry. In 1868 he was appointed director of the Academy of Forestry at Münden, a post which he resigned in 1878, to accept a professor's chair in the University of Munich. From 1856 to 1878 he edited the *Allgemeine Forst und Jagdzeitung*. Among his many works on forestry may be mentioned: *Lehrbuch der forstlichen Bodenkunde und Klimatologie* (Erlangen, 1856); *Anleitung zur Waldwertrechnung* (Leipzig, 1895; 4th ed. 1892); *Handbuch der forstlichen Statik* (Leipzig, 1871).

HEYER, Karl Justus (1797-1856). A noted German forester. He was born at Bessungen near Darmstadt, studied at Giessen and at Tharand, and at the age of twenty-one took active part in practical forestry, especially in the vicinity of Darmstadt, where he was then lecturing on forestry. In 1825 he was appointed instructor in the school of forestry at the University of Giessen, where, after having been also practical forester for Count Erbach-Fürstenau for four years, commencing in 1831, he became professor of forestry in 1835, a post he held until his death. During his incumbency he made many interesting contributions to the subject of forestry, in recognition of which a monument was erected in his honor at Giessen in 1892. Among his works may be mentioned: *Beiträge zur Forstwissenschaft* (Giessen, 1842 and 1847); *Anleitung zu forststatischen Untersuchungen* (Giessen, 1846); *Der Waldbau oder die Forstproduktenzucht* (Leipzig, 1854; 4th ed. by Richard Hess, 1891-93).

HEYLLI, ā'yā', Edmond Antoine Poinsot, called Georges d' (1833—). A French bibliographer and editor. He was born at Nogent-sur-Seine, and in 1877 became chief of the Bureau of the Legion of Honor. He is best known as a collector of anecdotes about celebrities, Louis XV., Countess du Barry, Mme. Emile de Girardin, Marshal Ney, Madame Rachel, and others, and published a number of books, such as *Le scandale au théâtre* (1864); *Dictionnaire des pseudonymes* (1867), of which a third and enlarged edition came out twenty years later. He founded (1876) the *Gazette Anecdotique, Littéraire, Théâtrale*, brought out curious editions of *Manon Lescaut* and of *Paul et Virginie*, and collected a number of interesting documents relating to the War of 1870 and the Commune.

HEYLYN, hī'lĭn, Peter (1600-62). A Church of England divine. He was born at Burford, in Oxfordshire, November 29, 1600. He studied at Oxford, and through the interest of Laud, in whose theory of Church and King he devoutly believed, was appointed chaplain-in-ordinary to King Charles in 1630. Subsequently he held a variety of livings, but was deprived of them during the period of the Commonwealth. In 1651 he became blind. At the Restoration he was made subdean of Westminster as a reward for his literary services to the royal cause. He died in London, May 8, 1662. Heylyn was a very voluminous controversial writer, but his works are of no value now, except as illustrative of the age in which he lived and the ecclesiastical party to which he belonged. For his life, consult Robertson in his edition of Heylyn's *Ecclesia Restaurata* (London, 1849).

HEYNE, hī'ne, Christian Gottlob (1729-1812). A German classical scholar, born at Chemnitz, in Upper Saxony, September 25, 1729. His father was a poor weaver. The pastor of Chemnitz, himself very poor, had Heyne educated at a school in the suburbs, and afterwards sent him to the University of Leipzig, where he suffered from extreme poverty. In 1753 he obtained a situation as copyist in the Brühl Library at Dresden. While in this office, he prepared his edition of *Tibullus*, which appeared in 1755, and roused the admiration of Ruhnken of Leyden. In 1756, unfortunately for Heyne, the Seven Years' War broke out. Frederick the Great marched against Dresden, and burned, among other things, the Brühl Library, but not before Heyne had edited, from a *codex* there, the *Enchiridion* of Epictetus. For some time he led a precarious life, being often without employment and without bread. In 1761 he married, and supported himself as best he could by writing for the booksellers; and in 1763 he was appointed professor of rhetoric at Göttingen on the recommendation of Ruhnken. This closed his period of misfortune. The rest of his long life was spent in comfort and professional activity. He died July 14, 1812. The principal works of Heyne, besides those mentioned, are his editions of Vergil (1767, 6th ed. 1803); Pindar (1774); Apollodorus (1787); Pliny (1790); Conon and Parthenius (1798); and Homer (8 vols., 1892; 2d ed. 1804). He published many translations, besides some ten or twelve volumes of minor works, of which six volumes were published separately under the title of *Opuscula Academica* (Göttingen, 1785-1812); and, finally, a great many reviews of books in the *Göttinger Gelehrte Anzeigen*, of which he was editor from 1770. In addition to this work, he had a seminar for the advanced study of philology and classical antiquity, from which he sent forth, in the course of his life, no fewer than 135 professors. Consult the life of Heyne by his son-in-law, Ludwig Heeren (Göttingen, 1813), and Carlyle's essay, *On the Life of Heyne.*

HEYNE, Moritz (1837—). A Germanic philologist. He was born at Weissenfels, studied at Halle, and became docent there in 1864, and professor in 1869. In the following year he went to Basel as professor of German language and literature, and in 1883 was called to a similar chair at Göttingen. His most widely known work is that in the continuation of Grimm's *Deutsches Wörterbuch* (in which he edited the letter H, I, J, L, M, R, and part of S) and his own *Deutsches Wörterbuch* (1890-95). More important possibly is his work in phonetics and old Germanic literature: *Kurze Laut- und Flexionslehre der altgermanischen Dialekte* (3d ed. 1880); *Altsächsische und altniederfränkische Grammatik* (1873); editions of Beowulf (6th ed. 1898; also a metrical translation of Beowulf, 1898); of Heliand (3d ed. 1883); and *Altdeutsch-lateinische Spielmannsgedichte des zehnten Jahrhunderts* (1900); and in antiquities: *Kunst im Hause* (1881-83) and *Fünf Bücher deutscher Hausaltertümer* (1899-1901, the first two parts).

HEYNLIN, ā'lăN', Johannes (c.1425-96). A prominent theologian and humanist of the fifteenth century, variously called *a Lapide* and *Lapidanus*. He studied at Leipzig, at Basel, and at Paris, where, in 1468, he was made rector of the university, and in the same year, and in 1470, prior of the Sorbonne. After teaching at Basel and the new University of Tübingen (1478), he was preacher in the cathedral of the former city (1484), but retired to a cloister three years afterwards. With Fichet he introduced the art of printing in Paris (1469). Consult Fischer, *Johannes Heynlin, genannt a Lapide* (Basel, 1851).

HEYNRICHS, hin′riks, J. N. The pseudonym of the German author and reformer Jenny Hirsch (q.v.).

HEYSE, hi′*ze*, Johann Christian August (1764-1829). A German grammarian and lexicographer, born at Nordhausen, and educated at Göttingen. He taught at Oldenburg, in his native town, and in Magdeburg. His writings, practical rather than scholarly in nature, are: *Allgemeines Fremdwörterbuch* (17th ed. 1892); *Deutsche Schulgrammatik* (26th ed., by Lyon, 1900); and *Leitfaden zum Unterricht in der deutschen Sprache* (25th ed. 1885).

HEYSE, Karl Wilhelm Ludwig (1797-1855). A German philologist, son of Johann Christian August Heyse, born at Oldenburg. In 1816 he began his studies of philology and linguistics under Böckh and Bopp at Berlin, where he became professor in 1829. His work at first was mainly in Latin and Greek, but after his father's death he took up Germanics as well, and revised many of his father's works, especially the *Allgemeines Fremdwörterbuch*. His own works are: *Handwörterbuch der deutschen Sprache* (1833-49), which is both practical and scholarly; *Ausführliches Lehrbuch der deutschen Sprache* (1838-49), popularizing the results of historical and comparative linguistics; and *System der Sprachwissenschaft*, his most important work, edited by Steinthal (1856).

HEYSE, Paul (1830—). A distinguished German author, the son of Karl Wilhelm Ludwig Heyse. He was born in Berlin, and educated there and at Bonn. A classical training was ripened by travel, during which he pursued in the libraries of Switzerland and Italy the philological researches, a taste for which was inherited. Even earlier, however, he had made his first dramatic essay on a subject which the romantic revival had made very popular. *Francesca da Rimini* (1850). A little later appeared his epics, *Die Brüder* (Berlin, 1852) and *Urica* (Berlin, 1851), which, when they were republished in 1854, made him so conspicuous that King Maximilian of Bavaria invited him to make Munich his home. Here he resided for many years with frequent visits to Italy, whose culture influenced all his writing deeply. In later life he spent most of his time in Italy on the banks of Lake Garda. The sum of Heyse's many and varied productions has made him a dominant figure among German men of letters. His prose fiction has been chiefly in the shape of short stories, for which he came to hold a high position in German letters. These tales are models of their kind, masterpieces in miniature, cameos in which every line leaves an impression. The best collection of them is *Das Buch der Freundschaft* (1883); the most famous single example is *L'Arrabbiata*. He also produced a few longer novels, tinged with radical thought on social and religious questions, especially: *Kinder der Welt* (1873); *Im Paradiese* (1875); and *Ueber allen Gipfeln* (1895), pessimistic in tendency, but fresh in style and gracefully light in movement. A large number of lyric and epic poems testify to a ripe culture, a warm imagination, and a suavity of expression which at times sacrifices strength to sweetness. The best-known of the longer poems is the epic *Thekla* (1858). In his dramas he maintained a high level, although he has not in any of them attained the highest dramatic rank. *Die Sabinerinnen* (1859), *Ludwig der Bayer* (1862), and *Hans Lange* (1866) are noteworthy among his earlier plays; and in the closing years of the century he produced some striking dramas, such as *Das verschleierte Bild von Sais*, *Der Heilige*, and *Maria von Magdala*, the last of which had a pronounced American success in 1902. At the same time he studied Italian literature and published a number of translations from the Italian. His *Complete Works* were first published in 1871, but large additions have since brought the number up to some forty volumes. His reminiscences, *Jugenderinnerungen und Bekenntnisse*, appeared in 1900. Consult: Brandes, *Moderne Geister* (Frankfort, 1887); Kraus, *Paul Heyses Novellen und Romane* (ib., 1888).

HEY′WARD, Thomas, Jr. (1746-1809). An American jurist, one of the signers of the Declaration of Independence. He was born on the estate of his father, a wealthy planter of Saint Luke's, South Carolina, and was educated in his native parish and in London, where he went to finish his law studies. His observations there and in other parts of Europe sent him home with strong republican ideas. From 1776 to 1798 he represented North Carolina in the Continental Congress, was a judge of the civil and criminal court in his native province from 1780 to 1798; was a captain of artillery in the war, and became a prisoner of the British at the surrender of Charleston. He was a member of the State convention for framing a constitution in 1790, and retired into private life the following year.

HEY′WOOD. A town in Lancashire, England, on the Roach, 9 miles north of Manchester (Map: England, D 3). It is an important centre of the cotton manufacture, has extensive coal-mines, iron and brass foundries, boilermaking, railway plant, and chemical works. It possesses handsome churches and other fine buildings. The municipality provides water, gas, markets, baths, fire brigade, technical school, free library, hospital, cemeteries, and owns a spacious park and recreation ground. Its incorporation dates from 1881. Population, in 1891, 23,300; in 1901, 25,460.

HEYWOOD, John (c.1497-c.1577). An English author, sometimes called 'The Old Epigrammatist.' The place of his birth has not been definitely ascertained, but it was probably London or North Mimms, Hertfordshire. At an early age he came to Court, introduced, according to some traditions, by Sir Thomas More; and the "Book of Payments" of Henry VIII. shows him to have been in the royal service in 1515. He found great favor at the Courts of Edward VI. and Mary, where his quickness at repartee and his witty imagination, besides the literary flavor of his writings, made him the superior intellectually of the usual Court jester. Shortly after the accession of Queen Elizabeth, he withdrew to Malines, Belgium. Of his literary remains the first chronologically were five *Interludes,* printed between 1533 and 1569. There are frequent plagiarisms from Chaucer, but they contain some original humor and vigorous satire; and the semi-dramatic form in which they are cast places them among the precursors of English comedy. A more ambitious but less successful production was *The Spider and the Fly,* which was printed in 1556. Written partly as a compliment to Queen Mary for her theological attitude, it represented Roman Catholics as the flies and Protestants as the spiders, with the Queen as the housemaid wielding her destroying broom. His best-known and most popular writings were the *Epigrammes,* the first extant edition of which bears the date 1562. The *Interludes* included: *A mery Play between the Pardoner and the Frere, the Curate and Neybour Pratte* (1533); *A mery Play between Johan the Husbande, Tyb the Wife, and Syr Han the Priest* (1533); *The Four P's* (1569); *The Play of the Wether* (1533); and *The Play of Love.* His other works besides those mentioned were *A Dialogue on Wit and Folly,* and several ballads. Consult: Halliwell, *Dictionary of Old English Plays* (London, 1860); Sharman's Introduction to an edition of the *Proverbs* (London, 1874); and Symond, *Shakspere's Predecessors in the English Drama* (London, 1884).

HEYWOOD, THOMAS (c.1575-c.1650). A celebrated English dramatist and general writer, born in Lincolnshire. He seems to have studied at Cambridge. By 1596 he was apparently writing for the stage, and two years later he was engaged by Philip Henslowe as an actor. Heywood was a most prolific writer. In 1633 he claimed to have had "an entire hand, or at the least a main finger," in 220 plays. His career was not yet ended. Of these plays only twenty-four are extant. The best of them is a domestic drama entitled *A Woman Killed with Kindness,* performed in 1603. This play brings us close to the heart of English middle-class life. Somewhat similar to it is *The English Traveller* (1633). Representative of his work in low life is *The Wise Woman of Hogsdon* (1638). There are three admirable comedies of adventure: *The Captives, The Fair Maid of the West,* and *Fortune by Land and Sea.* Besides his 220 plays, Heywood wrote many pageants, triumphs, elegies, a long heroic poem entitled *Troia Britannica,* a universal chronicle history (1609); *An Apology for Actors* (1612; reprinted for the Shakespearean Society, 1841); *Nine Books of Various History Concerning Women* (1624); *The Hierarchy of the Blessed Angels* (1635); and much else. He also made translations from Sallust, Lucian, Erasmus, and others. He died about 1650. Consult: *Dramatic Works,* ed. by Pearson (6 vols., London, 1874); *Thomas Heywood,* a selection from his plays, ed. by J. A. Symonds and A. W. Verity, "Mermaid Series" (London, 1888); *Old English Plays,* ed. by Bullen, vol. iv. (London, 1885); and Ward, *History of English Dramatic Literature* (New York, 1899).

HEZ'EKI'AH (Heb. *Khizkiyāh,* Yahweh is my strength). King of Judah, son of Ahaz. His reign may be approximately fixed as extending from B.C. 720 to 691. He ascended the throne at an early age—probably less than twenty—and appears to have been early influenced by the discourses of the prophet Isaiah, through whom he was induced to remove from the cult at Jerusalem certain practices, such as the worship of the brazen serpent (II. Kings xviii. 3, 4). We possess but little authentic information about Hezekiah's reign. The most important event was an invasion of Palestine by Sennacherib (q.v.), King of Assyria, c.701 B.C. With the help of the cuneiform annals of Sennacherib we can obtain a tolerably clear idea of this campaign, which was undertaken to offset the efforts of Babylonian and Chaldean chieftains like Merodach-Baladan (cf. II. Kings xx. 12-19) to make alliances with nations to the west whom Assyria claimed as vassals. Hezekiah and other rulers, such as the chiefs of the Philistines, of Edom and Moab, had actually promised Merodach-Baladan aid in making Babylon independent of Assyria. Sennacherib, after overthrowing Merodach-Baladan, proceeds to the west to wreak vengeance on Hezekiah and his allies. He succeeds in quelling the uprising, and removes those who had shown themselves faithless to him. Sennacherib advances within a few miles of Jerusalem, but after exacting a heavy tribute, withdraws without capturing the Judean capital (II. Kings xviii. 13; xix. 36). This deliverance is said to be due to the 'angel of the Lord,' who 'smites' the Assyrian camp (II. Kings xix. 35). The traditional interpretation of the passage makes it refer to a pestilence. The more probable reason for the withdrawal was the receipt of news from some troublesome Babylonian province which obliged Sennacherib to return to his land, content with having once more made his authority recognized in the west. It is hardly likely that after this Hezekiah ventured on any campaigns, so that the account (II. Kings xviii. 8) of a successful conflict with the Philistines is probably to be placed at the beginning of his reign. From certain notices (e.g. Proverbs xxv.) it would appear that in his days considerable literary activity prevailed, though it is highly improbable that the King himself wrote anything. The song in Isaiah xxxviii., ascribed to the King as having been composed by him after a severe illness, belongs to the post-exilic period, on the evidence of the language and contents, and the entire story of this illness is probably a bit of legendary lore that has found its way into an historical narrative because it served to illustrate the view taken by a later age of Hezekiah, who had become idealized like David and Solomon into the model of a God-fearing, pious Israelite after the pattern of the Yahweh purists.

H. H. The initials denoting the authorship of Helen Hunt, *née* Fiske. See JACKSON, HELEN F. H.

HIAWATHA, hī'ȧ-wä'thȧ. A city and the county-seat of Brown County, Kan., 40 miles northwest of Atchison; on the Missouri Pacific and the Saint Joseph and Grand Island railroads (Map: Kansas, G 2). It has Hiawatha Academy and the Morrill Public Library. The city is chiefly important as the commercial centre of a fertile agricultural country, and has lumber-yards, grain-elevators, a flour-mill, foundries, machine-shops, etc. There are municipal waterworks and two electric-light plants, one of which is owned by the city. Population, in 1890, 2486; in 1900, 2829.

HIAWATHA, hī'ȧ-wạ'tȧ *or* -thȧ. A narrative poem by Henry Wadsworth Longfellow, founded on an Indian legend preserved in Schoolcraft's *Algic Researches,* and *History, Condition, and Prospects of the Indian Tribes of the United States.* However, the miraculously born hero is declared to be an Iroquois and not an Ojibway, according to other sources. Longfellow adopted the metre of the Finnish epic *Kalevala,* and was accused of taking the entire plan from that poem. But the incidents common to both show merely the recurrence of early myths.

HIB'BERT LECTURES, The. A course of lectures given annually in London, discussing some unsettled problem in religion or theology. The lectures are supported from a fund left by Robert Hibbert, a Jamaica merchant, who died in 1849, leaving his property in trust for the promotion of scholarship, particularly among Unitarians. By a wise provision the trustees were empowered to revise the terms of administration from time to time, and in the exercise of this power they established the lectures in 1878. The first series was delivered in that year by F. Max Müller on "The Origin and Growth of Religion," and succeeding series have been given by Kuenen, Beard, Reville, Page Renouf, Renan, Rhys Davids, Pfleiderer, Rhys, Sayce, Hatch, and others.

HIBERNATION (Fr. *hibernation, hivernation,* from Lat. *hibernare,* to hibernate, from *hibernus,* winter, from *hiems,* winter, Gk. *χιών, chiōn,* Skt. *hima,* Av. *zima,* winter), AND ESTIVATION (Fr. *estivation,* from Lat. *æstivare,* to pass the summer, from *æstivus,* pertaining to the summer, from *æstas,* summer; connected with Lat. *æstus, heat,* Gk. *αἴθειν, aithein,* to burn, AS. *ād,* funeral pile, Skt. *idh,* to kindle). A physiological state of dormant vitality in which many animals in northern countries are able to pass the winter. It should not be confused with the torpor of freezing, which is a pathological and usually a fatal condition. The immediate cause of hibernation is not cold, for many animals go into their winter sleep some time before winter is on. Nor is it the lack of food, for the great bat begins sometimes to hibernate as early as the end of July, at a time when its insect food is still abundant. Moreover, the winter season is not the only one passed by animals in this kind of torpor. In dry countries, at the approach of the dry season, when moisture, herbage, and consequently animal food will be scarce, many kinds of animals are enabled to survive until the time of plenty again by going into a prolonged stupor, which seems not to be very different in kind or duration from the hibernation of northern forms. The Germans have for these two conditions the words 'Winterschlaf' (winter sleep) and 'Sommerschlaf' (summer sleep). The latter state is known in English as 'estivation.'

DORMANT VITALITY, or 'rigor,' is a term used for an apparent suspension of vital activity, distinguished from death by the possibility of resuscitation. Two general classes may be distinguished: (1) Dormant vitality induced by external conditions; and (2) dormant vitality determined by internal conditions. The first class is of three kinds: (*a*) *Desiccation rigor.* There are certain animals, notably rotifers, tardigrades, and nematodes, which can be dried in a vacuum until they become immobile, and can remain thus immobile for days or even months until, on the addition of water, they become active again. The organism has probably not lost all of its water, but has passed into an encysted condition; it is not dead, but its metabolism is greatly reduced. Even snails and other animals which can protect their internal tissues from complete loss of water may live for months without showing external activity. (*b*) *Dark rigor* is induced in green plants and even in certain fungi by their removal for several days from the light. The sensitive plant treated thus becomes immobile. Light is essential to movement. The reverse, or 'light rigor,' has been seen in bacteria. (*c*) *Heat rigor.*—The sensitive plant, muscle, and various other forms of protoplasm become quiescent at a temperature a few degrees below that at which they are killed by heat. The rigor seems to be due to the beginning of the death changes. Cold rigor occurs in simple protoplasm as it approaches the zero (centigrade) temperature. The chlorophyll granules of Vallisneria move only about one mm. per minute at 1° C., and not at all at 0°; the rotation of Nitella ceases at 0° C.; in Tradescantia hairs, movement is wholly arrested on freezing the cell-cap. Even in seeds and bacteria, which are not killed by the lowest temperatures, all vital activities have probably ceased at 0°, for De Candolle found that in only one species out of ten could he get a seed kept at 0° to germinate, and even then germination was so retarded that it took from 11 to 17 days as opposed to 4 days at 5.7°. Likewise, bacteria do not multiply below 5° to 10°. Among animals Kuhne found Amœba cooled to near 0° almost motionless. Purkinje and Valentin first noticed that the ciliated epithelium of the frog ceased its movements at 0°. Muscles of the frog were found by Kuhne to become at —3° to —7° a solid lump, which did not, however, wholly lack irritability. The evidence of all these cases shows that activity nearly ceases in protoplasm at or near 0° C.

Determined by internal conditions, seeds, resting spores, cysts, gemmules of sponges, and statoblasts of Bryozoa are all conditions of natural dormant vitality. The period of dormancy is not unlimited, however, the alleged germination of seeds many hundred years old not being confirmed. This indicates that even with a slow rate of living the food material eventually becomes exhausted.

Belief in human dormancy rests largely upon a certain collection of cases observed in India and published by James Braid.

PHENOMENA OF HIBERNATION AND ESTIVATION. The physiological facts mentioned above must be considered in studying the phenomena of habitual animal dormancy under conditions of winter, seasons of drought, and so on. The respiration in winter sleep is diminished much more than in ordinary sleep, and consequently the heart-beat is very slow. The digestive organs are practically inactive. Many animals void almost no fæces during this period, and the anal opening of those bears that hibernate is closed by a resinous plug known to hunters as the 'seal.' The temperature of the body is lowered to that or nearly that of the air. The voluntary control of the muscles is lost, but there is an increased muscular irritability, an unusual sensitiveness to external stimuli. The slightest touch possible, even on the end of a quill of a hibernating porcupine, will result in deep breathing and perhaps muscular movements. There can be no sharp line drawn between normal sleep and the lethargy of hibernation, for there are all gradations in the depth and duration of this lethargy, beginning at the one end of the scale with what might, perhaps, be simply termed sleep, and ending with animals that do not once wake up from the hibernating stupor until the time for its final termination has come.

Nearly all of the burrowing rodents are hibernaters, especially, in the United States, the woodchuck. A number of animals indulge in alternate periods of waking and hibernation. The English squirrel, the hedgehog, and the mourning-cloak butterfly are frequently awake on warm days in winter. Grain-storing animals spend a great deal of their time in sleep, but when hungry they awake to partake of their food-supply, or go outside in search of fresh food if weather permits. In the case of the northern brown, black, and polar bears only the female hibernates in the strict sense of the word, probably because she must remain quiet until her young is born, often before the snow releases her. The males sleep a great deal, but they go out now and then in search of food. A number of animals of wide range of distribution hibernate in the northern but not in the southernmost parts of their range. Such is the case with the American prairie-dogs and the skunk. In the centre of their range they are awake and active during warm winters or warm days in winter. Thus there are all degrees of torpidity, and likewise gradations between ordinary periodical sleep and hibernating dormancy. Although we cannot understand why animals of one species should be active in winter while those of a nearly related species should hibernate, as is the case among mice, nevertheless, it is probably of advantage in the struggle for existence, since it enables animals to remain in certain geographical areas in which they could not possibly survive without long and perilous migrations twice each year. This is especially true of the small vegetable-eating animals of northern plains.

Mammals usually hibernate in hollow logs, in trees, in caverns, or even in burrows in the ground. Usually their winter homes are made additionally fitting by a bed or nest of dry grass and autumn leaves. Most of the hibernaters are entirely or in part vegetable feeders. All the grain-storing species are active all winter, or else are intermittent hibernaters.

Reptiles, amphibians, and some fishes hibernate. The land reptiles and amphibians bury themselves in the ground below frost-line and there remain until spring. Aquatic species, such as the water-turtles, burrow in the mud at the bottom of streams. A few fishes, such as carp, chub, minnows, and eels, likewise lie throughout the coldest part of the winter in the mud and débris at the bottom of the water. Various snakes crawl into crevices between rocks, or into hollows beneath stumps, or take possession of gopher-burrows and the like, or even burrow themselves into loose soil, and pass the winter often wrapped in a tangled mass composed of scores of individuals of the same species. The temperature of these sinks to that of the water or mud in which they lie; and those of a northern habitat can endure a stress of cold to which individuals of the same species living in a warmer region will succumb.

Among the invertebrates, land-snails hibernate within their closed shells. They also afford the most conspicuous American example of estivation. When the dry, hot weather of midsummer approaches many species secrete two or three diaphragms across the aperture of their shells, and behind these remain as torpid as in winter until tempted out by a prolonged shower, until the autumn coolness and dampness arrive. Slugs bury themselves in the ground, and the bivalve mollusks in the mud at the bottom of streams and ponds. A great many of the other land invertebrates survive as eggs or spores which remain inactive during the winter, and begin to develop on the return of spring. Spiders, more or less active, hide under fallen leaves or bark, and in other secluded places. Insects pass the winter in all stages of development. A number of beetles, flies, bugs, and a few butterflies winter as adults in northern climates. A large number of butterflies and moths pass the winter as pupæ, frequently protected by a silken cocoon. Several kinds of caterpillars are able to survive the winter either in spun nets or in sheltered hollows or chinks. A vast host of insects survive as eggs, whose development is delayed until spring.

Upon waking from their stupor the heat of the body of hibernating animals very quickly increases to the normal. Hunger is probably the chief agent that calls such animals to activity again. The most profound sleepers can scarcely be kept awake when brought into a warm room and stimulated. Partial hibernaters, after a hearty meal in winter, resume their torpor again. The air under a bell jar, in which a hibernating dormouse is put, remains unchanged. Hall kept a hibernating bat under water fifteen minutes without fatal effect, while a wakened bat will succumb after three minutes. Carbon dioxide, which is speedily fatal to active animals, has no effect on a torpid marmot. Hibernaters lose their weight in winter to the extent of 30 to 40 per cent. This loss of weight indicates that, notwithstanding their great diminution, the vital processes are going on in the hibernating animal all the time.

Consult: Hall, "Hibernation," in Todd, *Cyclopædia of Anatomy and Physiology*, vol. ii. (London, 1838); Browne, *Animal Torpidity and Hibernation* (Philadelphia, 1847); Semper, *Animal Life* (New York, 1881); Gadow, Beddard, Sharp, and other writers in the *Cambridge Natural History* (London, 1895-1903).

HIBER'NIA, IVERNA, JUVERNA, or **IERNE** (probably connected with Welsh *Ywerddon*, MBret. *Yuerdon*, Ir. *Erin*, *Herin*, Ireland, akin to Gk. Πιερία, *Pieria*, name of a district in Greece, Skt. *pīvan*, fat; cf. also MWelsh *Ewyrdonic*, Irish). Names by which Ireland is designated in the classical writers. Aristotle speaks of two islands situated in the ocean beyond the Pillars of Hercules, which were called Albion, and Ierne, beyond the Celtæ. Both Diodorus Siculus and Strabo report the natives to be addicted to cannibalism, but without proof. Pomponius Mela declares the herbage to be so luxuriant that the cattle which feed on it sometimes burst. Pliny repeats this statement, and adds that the Hibernian mother trains her child from the very first to eat food from the point of a sword. The most important of all classical authorities on Hibernia is Ptolemy, who describes the country, and gives the names of the principal rivers, promontories, seaports, and inland towns. The island was never conquered by the Romans. See IRELAND.

HIBERNIANS, ANCIENT ORDER OF. A prominent Catholic Irish organization. The society was instituted originally for the protection of the Catholic priesthood and religion in Ireland, but it has now as its main object 'the advancement of the principles of Irish nationality.' According to some authorities the order was first instituted in 1642, following the great uprising in the north; according to others, in 1651, when Cromwell had proclaimed nearly the whole native population outlawed, and had put a price upon the head of every priest and made it death to attend a Catholic service. The founder was Rory Og O'Moo, and the society was at first known as The Defenders. On the establishment of Catholic emancipation, in 1829, the society was reorganized under its present name as a beneficial and nationalist organization. It was soon afterwards extended to England and Scotland and was introduced into the United States in 1836. Its membership is restricted to persons of Irish birth or descent and of Catholic faith. Military drill is a prominent feature in some of the branches. The order is an active supporter of the present Gaelic movement (see GAELIC LEAGUE), having endowed a Celtic chair at the Catholic University of America, and contributed generously toward the support of Gaelic organizers in Ireland. The latest report shows that, including the ladies' auxiliary, the American branch had a membership of 150,000, and disbursed annually nearly $1,000,000 in benefits. This branch is closely affiliated with the parent body in Ireland, as well as with those in England, Scotland, Australia, and other parts of the world.

HIBER'NICISM. A term used to denote an Irish bull, i.e. a sentence expressing ideas that a moment's thought would show to be incompatible and absurd. A famous bull was made, it is said, by Sir Richard Steele when inviting a certain lord to visit him: "If, sir, you ever come within a mile of my house, I trust you will stop." Curran also used to relate a fine specimen: He started one day to attend a levee at the castle in Dublin. There was a long line of carriages, and he was suddenly startled by the pole of the carriage behind crashing into the back of his own carriage. He hastily called to his coachman to stop, saying. "The pole of the carriage in the rear is driven into ours." "And, sure, it's all right again, thin, your honor," cried Pat, "for I've just drove me pole into the carriage in front." Richard and Maria Edgeworth wrote a learned treatise entitled *An Essay on Irish Bulls* (1802); and Maria Edgeworth's *Castle Rackrent* (1800) is full of the most delightful blunders in speech.

HIBIS'CUS (Lat., from Gk. *ἱβισκος*, *hibiskos*, mallow). A genus of plants of the natural order Malvaceæ, the numerous species of which are shrubs or trees, but mostly large herbaceous annuals and perennials, natives of warm climates. The flowers of many are very beautiful. *Hibiscus syriacus*, a native of Syria and Carniola, has long been in cultivation as an ornamental shrub and has proved hardy in Great Britain and parts of the United States. Some are favorite hothouse plants. The characteristic mucilaginous and fibrous properties of the Malvaceæ are very strongly developed in this genus. *Hibiscus abelmoschus* so abounds in mucilage that it is much used in the northwest of India for clarifying sugar. The unripe fruit of *Hibiscus esculentus*, an annual plant with a soft herbaceous stem three to five feet high, crenate leaves, axillary sulphur-colored flowers, and pyramidal, somewhat pod-like capsules, is in general use both in the East and West Indies for thickening soups, and otherwise as an article of food. It is called okra, gumbo, gombo, gobbo, and ochro in the West Indies and Southern United States; bandikai, ram-turai, and denroos in different parts of India; and bammia in the west of Africa. The bark of *Hibiscus tiliaceus*, a tree twenty feet high with a very thick bole, abounds in mucilage and is chewed by natives of the South Sea Islands when food is scarce. This tree, the bola of Bengal, and the moho, majagua, or mohaunt of the West Indies, is one of the most abundant trees of the South Sea Islands; and the wood, which is light, tough, and durable, is much used for many purposes. The very porous bark is made into cordage and matting in various tropical countries. Many other species yield fibres, some of them coarse, others fine and beautiful, which are used in different countries; but the most important in this respect is *Hibiscus cannabinus*, the Ambaree hemp, and Deccan hemp of Western India, called palungoo at Madras, and mesta pat in Bengal; a plant very generally cultivated in all parts of India, although nowhere to a great extent. It is an annual herb with a straight, unbranched stem, three to seven feet high. The fibre is not so strong as hemp, and is useful only for ropes and coarse fabrics. It has been suggested that many species of Hibiscus might be found valuable for the manufacture of paper. *Hibiscus sabdariffa*, Jamaica sorrel or roselle, is very generally cultivated in warm countries, on account of its calyx, which, as the fruit ripens, becomes fleshy, and acquires a very pleasant acidity. It is much used for making tarts and jelly, and a decoction of it, sweetened and fermented, affords a refreshing beverage. *Hibiscus abelmoschus*, sometimes called musk-mallow, another plant common in widely scattered tropical countries, is cultivated for its seeds, called ambrette, or *graines d'ambrette*,

HIBISCUS SYRIACUS.

which have a fragrance intermediate between musk and amber, and which are much used by perfumers. In Egypt and Arabia, these seeds are mixed with coffee, and stimulant and stomachic qualities are ascribed to them. The petals of *Hisbicus rosa-sinensis* are astringent, and are used by the Chinese to blacken their eyebrows and their shoes. A number of species of Hibiscus are cultivated as ornamental plants in the United States. There are also several indigenous species.

HICCOUGH, hĭk'kŭp, or **HICCUP.** Sudden short, convulsive inspirations, attended with a peculiar sound produced in the larynx by the inrush of air. The movements concerned in the production of hiccough are a spasmodic contraction of the diaphragm, and a certain degree of constriction in the glottis, which occasions the peculiar sound, and limits the amount of air inspired. These convulsive inspirations commonly succeed each other at intervals of a few seconds. The paroxysm may last only a few minutes; or may extend to hours or days, in which case it may be dangerous to life, from the exhaustion which it causes. Over-distention of the stomach, the ingestion of cold water, excessive acidity, etc., will provoke it. Certain diseases are frequently attended by hiccough. It occurs occasionally after severe hemorrhage, in debilitating diseases, pneumonia, peritonitis, appendicitis, etc., in which cases it is a grave symptom.

When the attack is slight it may often be stopped by making a very full inspiration, and then holding the breath as long as possible, the diaphragm being thus held in a state of voluntary contraction. A drink of water gives relief in ordinary cases. In more obstinate cases, aromatic spirit of ammonia, camphor, musk, etc., may be resorted to. When hiccough continues for an hour or more and the exhaustion is great, an anæsthetic may be necessary.

HICH'BORN, Philip (1839—). An American naval officer. He was born in Charlestown, Mass., studied in the Boston High School, was a shipwright apprentice in the Boston Navy-Yard, and, having gone to California in 1860, became master shipwright of the Mare Island Navy-Yard (1862). He entered the Navy in 1869, with rank of lieutenant, and served as assistant naval constructor until 1875, when he was commissioned full constructor. Four years afterwards Hichborn was sent to Europe to report on foreign dock-yards, and his book on this subject is a standard text-book. Having served on the Board of Inspection and Surgery, in 1881 he was appointed to the Naval Advisory Board. In that capacity and as chief constructor (appointed 1893 and 1897) he was prominently connected with the construction of the new navy. He was retired 1901, with the grade of rear-admiral.

HICH'ENS, Robert Smythe (1864—). An English novelist, born at Speldhurst, in Kent. He was educated at Clifton College, the Royal College of Music, and the London School of Journalism, and became a member of the staff of the London *World*. He began early to write musical lyrics and stories. His *Green Carnation* (1894), published anonymously and attributed to Oscar Wilde, created a sensation. It is a satire on the decadents. Among succeeding novels are: *An Imaginative Man* (1895); *Flames* (1897); *The Slave* (1899); *Tongues of Conscience*, short stories (1900); *The Prophet of Berkeley Square* (1901); and *Felix* (1902). He has also collaborated in successful plays, as *The Medicine Man* and *Becky Sharp*.

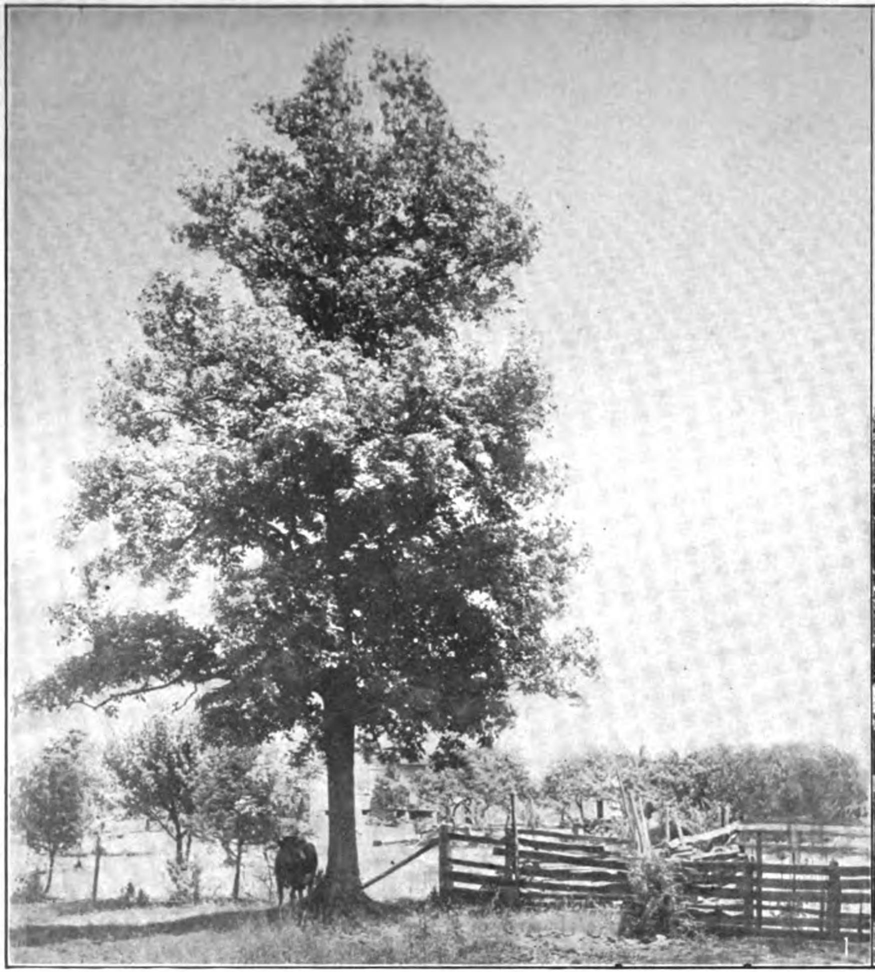
HICKES, George (1642-1715). An English non-juring clergyman, philologist, and author. He was born at Newsham, Yorkshire; studied at Northallerton Grammar School, then proceeded as sizar to Oxford, where he graduated B.A. In 1664 he received a fellowship of Lincoln College, and the following year received his M.A. degree. He took holy orders in 1666, was a tutor for several years, visited France in 1673, was appointed rector of Saint Elbe, Oxford, in 1675, and in 1676 became chaplain to the Duke of Lauderdale, whom he accompanied on his journey as High Commissioner to Scotland. Several rapid promotions culminated in a chaplaincy to James II. and the Deanship of Worcester (1683). At Worcester his study of the Germanic languages resulted in the publication of the *Anglo-Saxon and Mœso-Gothic Grammar* (1689). At the time of the Revolution he refused to take the oath of allegiance to William and Mary, and was deprived of his benefices. In 1693 he visited the exiled King at Saint Germains, with a mission from the non-juring clergy for coördinate action in regard to the continuance of their episcopal rights, and in 1694 he was consecrated by their leaders as Suffragan Bishop of Thetford. His subsequent publications in controversial and practical divinity were numerous. His greatest work is *Linguarum Veterum Septentrionalium Thesaurum Grammatico-Criticum et Archæologicum* (3 vols., 1703-05). Among his other writings are: *Controversial Letters* (1710); *Sermons* (1711); and a volume of *Posthumous Discourses*, published in 1726.

HICK'EY, Emily Henrietta (1845—). An English poet, born at Macmine Castle, Wexford, Ireland. With F. J. Furnivall she founded the Browning Society (1881), and she became known as a lecturer. In 1902 she edited *Havelok the Dane*, a Middle-English romance. Among her volumes of poems are: *A Sculptor and Other Poems* (1881); *Verse Tales* (1889); *Michael Villiers, Idealist, and Other Poems* (1891); *Poems* (1895); *Our Lady of May and Other Poems* (1902).

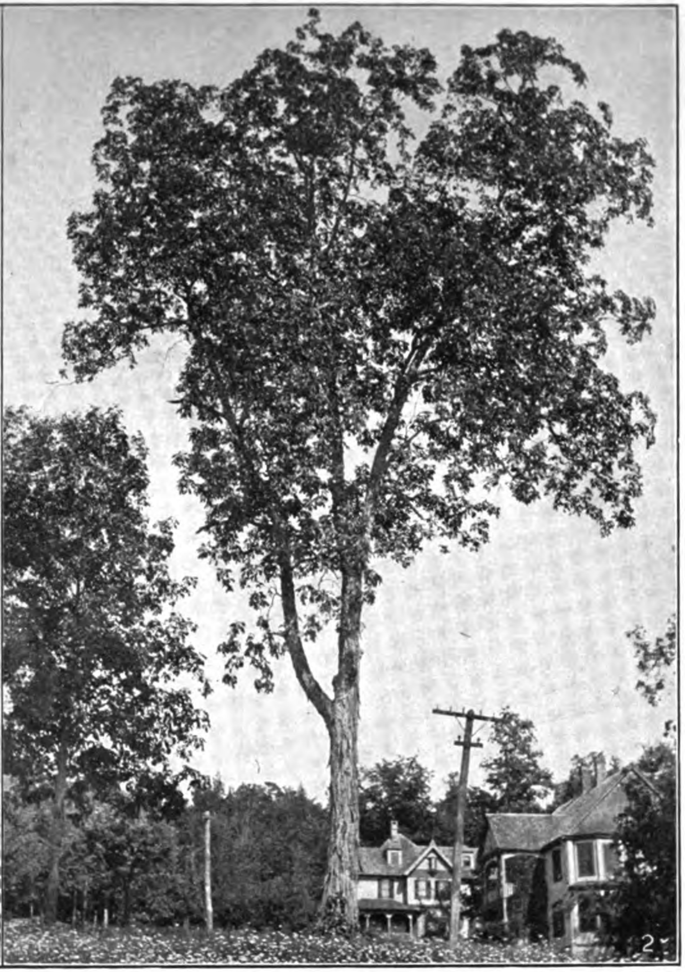
HICK'OK, Laurens Perseus (1798-1888). An American writer on philosophy. He was born in Bethel, Conn.; was pastor at Newtown, Kent, and Litchfield, Conn. (1822-36); professor of theology in Western Reserve College, Ohio (1836-44); professor in Auburn Theological Seminary (1844-52); professor of mental and moral science in Union College, and vice-president (1852-66) and president (1866-68). After his resignation of the last-named office, Dr. Hickok resided at Amherst, Mass. Among his published works are: *Moral Science* (1853); *Mental Science* (1854); *Rational Cosmology* (1858); *Rational Psychology* (1861); *Humanity Immortal* (1872); *Creator and Creation* (1872); *Logic of Reason* (1874). He died May 6, 1888.

HICK'ORY. A town in Catawba County, N. C., 50 miles northwest of Charlotte; on the Southern Railway (Map: North Carolina, A 2). It is the seat of Lenoir College (Lutheran), opened in 1891, and of the Claremont Female College, opened in 1880, and has Saint Paul's Lutheran Seminary and other educational insti-

HICKORIES



1. BITTERNUT HICKORY (Carya amara).



2. SHAGBARK HICKORY (Carya alba).

tutions. There are manufactures of flour, lumber, foundry products, carriages and wagons, leather, etc. Population, in 1890, 2023; in 1900, 2535.

HICKORY (formerly *hiccory, pohickery,* from the North American Indian name), *Carya,* or *Hicoria.* A genus of trees formerly included among walnuts (Juglans). The hickories are exclusively North American. They are large and beautiful trees, with pinnate leaves, and attain a height of 70 or 80 feet. Their timber is very heavy, strong, elastic, and tenacious, but decays speedily when exposed to heat and moisture, and is peculiarly liable to injury from worms. Great quantities of hickory are used to make hoops for casks. It is much used for handspikes, axe-handles, baskets, agricultural implements, etc., the second growth being tougher, is preferred for these purposes. When used for baskets the logs are cut into sections of the required length, steamed in vats, and cut in a veneering machine, after which they are chopped into splints of the required width. Shafts of carriages, handles of whips, and golf-clubs, large screws, etc., are made of hickory. It is greatly esteemed for fuel. The fruit of the hickory is a smooth, hard-shelled nut covered by a four-parted husk, which in most species separates to the base upon maturity. The nuts of some of the species are of excellent flavor. The shell-bark and shag-bark hickory are so called from their shaggy outer bark, which peels off in long, narrow plates. The hickories are found from Maine to Florida and west to Minnesota, Kansas, and Texas, and extending into Mexico, several species occurring throughout the entire range. The trees are mostly slow growing. In forests they grow tall with few limbs, but in the open they branch widely and have many desirable qualities desired in park trees.

SHELLBARK HICKORY (*Carya sulcata*).

The principal species, according to different authorities, are:

		Gray	Britton and Brown	
Pecan	*Carya*	*olivæformis*	*Hicoria*	*pecan*
Shagbark hickory	"	*alba*	"	*ovata*
Shellbark hickory	"	*sulcata*	"	*lacinosa*
Mocker nut hickory	"	*tomentosa*	"	*alba*
Pig-nut hickory	"	*porcina*	"	*glabra*
Bitter-nut hickory	"	*amara*	"	*minima*
Water hickory	"	*aquatica*	"	*aquatica*
Nutmeg hickory	"	*myristicæformis*	"	*myristicæformis*
Mexican hickory	"	*Mexicana*	"	*Mexicana*
Small pig-nut hickory	"	*microcarpa*	"	*odorata*

HICKORY-POLE CANVASS. The name given to the canvass for Andrew Jackson in the Presidential election of 1828.

HICKORY SHAD. See MUD-SHAD.

HICKS, ELIAS (1748-1830). An American minister of the Society of Friends, born at Hempstead, Long Island. While still a young man of twenty he began to feel a deep interest in religion, and within a few years his upright life and his ability as a speaker gained for him universal recognition as a minister in the Society. During the next half-century he traveled widely through the Eastern States from Maine to Maryland, preaching and organizing new meetings. He was an earnest and influential advocate of abolition, not hesitating to speak against slavery even in such a slaveholding community as Maryland. To his efforts was due in large measure the passing of the act which emancipated all slaves in New York in 1827. He first became the leader of a faction in the Society in 1817. For a number of years before that there had been a determined effort made by some of the members to effect a closer union with the Friends of the English society, and as a step toward this was proposed the adoption of an orthodox creed, the main points of which were the deity of Christ and the vicarious atonement. The proposition met with considerable favor in Philadelphia, and a number of Friends from that city went down to the Baltimore yearly meeting in 1817 to advocate it there. Hicks, who was present, spoke eloquently against the measure, and secured its rejection. From that time may be dated the schism in the Society which became complete in 1828. Those who followed Hicks—called 'Hicksites' as a term of reproach—far outnumbered the orthodox, and for many years there was great bitterness of feeling between the two factions. Of late, however, this has largely disappeared. Hicks published: *Observations on Slavery* (1811); *Sermons* (1828); *Journal of the Life and Religious Labors of Elias Hicks* (1832); and *Letters* (1834).

HICKS, JOHN BRAXTON (1823—). An English gynecologist and anatomist, born at Rye, and educated at Guy's Hospital in London and at the University of London. In 1865 he became lecturer at Guy's Hospital, was later obstetrical examiner to the Royal College of Physicians, then (1892) consulting obstetric physician at Saint Mary's Hospital, president of the Obstetrical Society (1871-73), and Hunterian orator (1878). He wrote *The Honey Bee* (1860), with James Samuelson, besides many contributions to the *Guy's Hospital Reports,* to the *Transactions* of the Obstetrical Society, to the *Proceedings* of the Medical Society, and to the *Lancet.*

HICKS, THOMAS (1823-90). An American portrait painter. He was born in Newtown, Pa., October 18, 1823. He studied at the Philadelphia Academy, and afterwards at the National Academy, New York. Visiting Europe from 1845 to 1849, he studied with Couture in Paris. He was elected member of the National Academy in 1851, and established studios in New York, and Trenton, N. J. His color is good, his drawing is carefully executed, with elaborate accessories, and his composition is well balanced. He died in 1890. Some of his best-known portraits are: Edwin Booth as Iago, Henry Ward Beecher, Longfellow, Dr. Kane, William M. Evarts, Bayard Taylor, Hamilton Fish, Luther Bradish (1857); Henry Abbot (1863), in the Historical Society, New York; Parke Godwin (1879); Mrs.

S. F. Billings (1883); Dr. James R. Wood (1884), New York Academy of Medicine. Among his other subjects are: "Birches at Thornwood;" "Trenton Falls" (1879); "End of a Winter Day" (1885); "In Brittany" (1884).

HICKS, Thomas Holliday (1798-1865). An American politician, born in Dorchester County, Md. He became sheriff in 1824, and a member of the State Legislature a few years later; was a member of the State Electoral College and was again elected to the Legislature in 1836; and in 1837 served on the Governor's Council. From 1858 to 1862 he was Governor of the State. He strongly sympathized with the South, and was indignant with the Northern people for their general attitude toward slavery, and in particular for their refusal to enforce the Fugitive Slave Law. When actual hostilities between the two sections began he seemed to think that the State could assume a neutral attitude, and largely by his refusal to call a special session of the Legislature managed to block radical measures. He saw that secession for Maryland meant devastation, and his policy gradually evolved itself until he found himself vigorously opposing secession and defying the Legislature. Rumors were current in the early part of 1861 of a plot, in which 3000 citizens of the State were organized to prevent Lincoln's inauguration and seize the city of Washington. He made preparations to thwart the attempt, caused State arms to be seized, suspended the writ of habeas corpus, planned the arrest of suspected persons, and indorsed the Administration in establishing a censorship of the press and in breaking up the Legislature. The proximity and alertness of the Federal headquarters was in reality all that prevented a serious secessionist movement, Hicks being the only prominent official of the State who stood by the Government. At the expiration of his term as Governor a new Legislature passed resolutions thanking him in its name and in the name of the people of Maryland for his attitude during the crisis, and declaring that it was he who had kept the State from joining the Confederacy. In 1862 Lincoln offered him the rank of brigadier-general, but ill health prevented his acceptance. In the same year he was appointed to the Senate to supply the vacancy occasioned by the death of Senator Pearce, and served in that body during the remainder of his life. Although he was at the same time denounced for selling the State to Lincoln, and praised for saving it by his remarkable ability, it is largely the uniqueness of the position in which he was placed which makes him especially memorable. Consult: Radcliffe, "Governor Hicks of Maryland and the Civil War," in the *Johns Hopkins University Studies in Historical and Political Science*, nineteenth series, Nos. xi., xii. (Baltimore, 1901).

HICKS, William. See Hicks Pasha.

HICKS-BEACH, Sir Michael Edward (1837—). An English Conservative politician, born in London. He was educated at Eton and Christ Church, Oxford; entered Parliament in 1864, and after 1885 represented West Bristol. He was Chief Secretary for Ireland from 1874 to 1878, and Secretary of State for the Colonies in 1878-80. In 1885 Lord Salisbury appointed him Chancellor of the Exchequer and leader of the House of Commons. In 1886 he again became Secretary for Ireland, but held the office less than a year. He was President of the Board of Trade from 1888 to 1892. In 1895, after the fall of the Gladstone Ministry, he became Chancellor of the Exchequer, from which post he resigned in 1902, immediately after the retirement of Salisbury. In the character of strict economist he greatly embarrassed the Balfour Government by an attack (October, 1902) on the finances of the War Office, in which he insisted that that department was not spending to best advantage the money assigned to it.

HICKSITES. See Friends.

HICKS PASHA, pȧ-shä′ (William Hicks) (1831-83). An English soldier. He entered the British East Indian army as an ensign in 1849, and left the service in 1880 as an honorary colonel. Three years later he was appointed to the command of the Egyptian army in the Sudan, and with a force of from ten to twelve thousand native troops went against the Mahdi. He at first won what seemed a decisive victory near Khartum in April. In September, however, he went with a force of 10,000 to suppress a rebellion, and crossed the desert to El Obeid. Then Hicks Pasha found himself betrayed into an ambuscade, and after a battle of three days, ending with the massacre of nearly all his army, he fell in a last desperate charge of his mounted staff. Consult Colborne, *With Hicks Pasha in the Sudan* (London, 1884).

HIDAGE, hīd′ȧj (from *hide*, AS. *hīd*, *hīgid*, *hīged*, a certain portion of land, from ONorthumbrian *hīgan*, AS. *hīwan*, members of a family). An extraordinary tax paid to the kings of England on every 'hide' (q.v.) of land. It was abolished during the reign of Henry II.

HIDALGO, ē-ᴅäl′gō. A central State of Mexico, bounded by the State of San Luis Potosí on the north, Vera Cruz and Pueblo on the east, Tlaxcala and Mexico on the south, and Querētaro on the west (Map: Mexico, J 7). Area, 8917 square miles. The northern and northeastern portions are traversed by the eastern range of the Sierra Madre, and form a wild and rough mountain region, rising in its highest elevation to over 10,000 feet. The southern and western parts are mostly flat and traversed by fertile valleys. The climate is warm in the lower regions, and the agricultural products include cereals, sugar-cane, tobacco, coffee, and cotton. The State has extensive mineral wealth and mining is the chief industry. The chief mineral products are silver, quicksilver, copper, iron, lead, and zinc. Coal and marble are found. The southern part is traversed by several railway lines. Population, in 1900, 603,074. Capital, Pachuca (q.v.).

HIDALGO DEL PARRAL, dĕl pär-räl′. See Parral.

HIDALGO Y COSTILLA, ē-däl′gō ē kō-stē′-lyȧ, Don Miguel (1753-1811). A Mexican priest and revolutionist. He was born at Corralegos, studied at Valladolid in Mexico, and was given charge of the parish of Dolores, in the State of Guanajuato. Dissatisfied with the Government, he conspired with the Indians to raise a general insurrection on November 1, 1810. Fear of discovery led him to hasten his plans, and the revolt began in September in the town of Dolores. His eloquence had a powerful effect on the people, and to heighten the enthusiasm he carried aloft the banner of Our Lady of Guadalupe, patron saint of Mexico, and gave to his insurrection the character of a crusade. He took the towns of Guanajuato and Guadalajara, and with an army of 50,000 men marched on Mexico, defeating on the way a small force of soldiers sent to oppose him. But the decree of excommunication launched against him, and the discord prevailing among his lieutenants, caused his forces to melt away, and forced him to retreat. He succeeded, however, in reuniting his men to meet the army sent against him by the Government, but his disorderly mob of 100,000 men were pitilessly crushed by the onset of 6000 Spanish veterans, January 17, 1811. Hidalgo fled and set out for the United States to procure assistance, but was captured, degraded from his priestly office, and shot. Some years later he was extolled as a saint, and the new-born republic erected a magnificent statue to him.

HID'DENITE. A yellow-green to emerald-green variety of spodumene, discovered in 1879 by W. E. Hidden, in Alexander County, N. C. The transparent crystals, when cut and polished, resemble the emerald in lustre, although the color is not so intense as in the finer varieties of the latter gem. Hiddenite has a specific gravity of 3.19, and gems of 2½ carats in weight have been cut from it. When first introduced it aroused considerable interest on account of its novelty as an American gem. It is sometimes called the *lithia emerald.*

HIDE (AS. *hid, hīged, hīgid,* from ONorthumbrian *hīgan,* AS. *hīwan,* members of a family). In Anglo-Saxon law, the family estate, corresponding to the *huba* of early Germanic law. It consisted apparently of a farm, or allotment, of definite extent, though its size varied greatly at different periods of German and English history. The normal hide at the time of the Conquest was 120 acres. But the term does not seem to have been employed to denote a unit of land measurement, but a definite parcel of land in the nature of a homestead, owned in severalty by the head of a family. As such, however, it was used by the Saxon kings as a unit of taxation, the amount assessed on each hide being known as *hide-gild.* After the Conquest the term gradually changes its meaning and comes to designate a measure of land, but its signification is not free from obscurity at any period of its history. See Pollock and Maitland, *History of English Law* (2d ed., Boston, 1899); Stubbs, *Constitutional History of England* (Oxford, 1880); Jenks, *Law and Politics in the Middle Ages* (New York, 1898); Seebohm, *English Village Community;* Maitland, *Domesday Book and Beyond.*

HIDEYOSHI, hē'dā-yō'shē, TOYOTOMI (1536-98). A Japanese warrior and statesman, the son of a peasant. He was born in the village of Nakamura, Aichi Ken, province of Owari, in 1536; became groom to Nobunaga (q.v.), who made him a soldier. He speedily distinguished himself by his military talents, and in 1575 was by Nobunaga created lord of Chikuzen, and was allowed to change his family name to Hashiba. On the death of Nobunaga in 1582 he took such vigorous action that he became in 1586 the practical ruler of the Empire under the title of Kuambaku, or regent, a high office that had been reserved exclusively for members of the Fujiwara (q.v.) family. In 1591 he nominally retired in favor of his son Hidetsugu, taking, as was customary in such circumstances, the title of Taikō, hence popularly known as Taikō-sama. In 1592 he dispatched a large army to Korea to conquer it as a preliminary step in the conquest of China, but the expedition met with disaster, the Emperor of China having sent a large army to the assistance of the Koreans, and after his death at Kioto in 1598 it was recalled. Displeased with the conduct and teachings of the Jesuits, he ordered their expulsion, but no steps were taken to carry out this edict until 1596, when several Franciscan priests, Jesuits, and native Christians were crucified at Nagasaki. A monument in his honor was erected at Kioto in 1896. He had many names; Toyotomi he received from the Emperor. His posthumous name is Toyokuni. Consult: Adams, *History of Japan* (London, 1874); Dening, *Life of Hideyoshi* (Tokio, 1889); Griffis, *The Mikado's Empire* (New York, 1900); and Brinkley, *Japan, Its History, Arts, and Literature* (8 vols., beautifully illustrated, Boston, 1901-02).

HIEL, hēl, EMANUEL (1834-99). A Flemish poet, born at Dendermonde. At first he was a bookseller; then he obtained a minor Government appointment and later the position of professor of oratory at the Brussels Conservatory, and librarian of the Industrial Museum in the same city. He is generally considered the chief Flemish lyrist of recent times. Among his longer poems are *Jacobæa van Beieren* (1867; new ed. 1880) and *Bloemardinne* (1877). In addition to these there are the collections *Nieuwe liedekens* (1861); *Gedichten* (1863); *Bloemeken een liederkrans* (1877); and some verses for children, *Liederen voor groote en kleine kinderen,* many of which were adapted to well-known melodies, and some of which were set to music by Van Gheluwe, *Liedersolfege* (1875). Hiel's greatest works are the poems *Lucifer* and *De Schelde,* for which Benoit composed oratorio settings; *Vrijheidshymnus* (music by Richard Hol); and *Prometheus* (1868). An edition of his poetry, *Volledige dichtwerken,* was published in 1885.

HIEN FŬNG, hyĕn fŭng, or **HSIEN FÊNG,** syĕn fĕng. The name of the period during which I-chu, the seventh Emperor of the present Manchu dynasty of China, ruled; but the name is commonly transferred from the period to the Emperor himself. He was the fourth son of the Emperor Tao-Kwang, was born in 1831, and succeeded to the throne in 1850, but his reign, according to custom, dates only from the following year. He proved to be a weakling. At the beginning of his reign the Tai-ping Rebellion broke out in Canton Province; hordes of fanatics and lawless persons joined the standard of the 'Prince of Peace,' as the leader, Hung Hsü-Ch'üan, styled himself; half the country was devastated, and twenty millions are said to have been put to the sword. The rebellion would have taxed a stronger man, but able statesmen and generals arose, and in 1864 this greatest of all rebellions was crushed. Meanwhile a war with Great Britain had been precipitated in 1857 by an outrage on the British flag. Canton was for a second time taken by British troops, the Taku forts at the mouth of the Peiho were captured, and a treaty was concluded in 1858 opening more new ports, throwing the country open to travelers, permitting the preaching and the practice of Christianity, and calling for more indemnity. In the following year, as the British envoy was on his way to Peking to exchange ratification as previously arranged, he was fired upon, and his party driven back. This made another expedition necessary, and in 1860 another army (France joining) and fleet took the Taku forts a second time, captured Tientsin, and proceeded to Peking. Hien Fŭng fled to Jehol (q.v.), where he died in the following year, leaving his brother, Prince Kung, to negotiate a new treaty of peace, which in the circumstances was more rigorous than that of 1858. Additional ports were to be opened, and it was agreed that henceforth a British envoy or ambassador was to be allowed to reside at Peking, and in connection with this a Department of Foreign Affairs—the Tsung-li-Yamên—was established, Prince Kung becoming its first president.

HIERACITES, hī-ĕr′ȧ-sīts. See Hierax.

HIERACIUM, hī′ē-rā′shĭ-ŭm. See Hawkweed.

HIERAPOLIS, hī-ē-răp′ō-lĭs (Lat., from Gk. Ἱεράπολις, sacred city, from *ἱερός*, *hieros*, sacred + *πόλις*, *polis*, city). (1) A city in Southwest Phrygia, about six miles north of Laodicea. It was the religious centre of the native worship of the district, and was an important seat of the mysteries of the Phrygian nature-goddess, who was here called Leto, her daughter, Cora, a male deity, and a son. It possessed warm springs which had, and still have, a remarkable power of forming incrustations. Its religious fame was also increased by the Plutonium or Charonium, a narrow but deep chasm, from which issued a noxious vapor, supposed to be fatal to all except the eunuch priests of the goddess. This chasm had disappeared in the fourth century A.D. Consult: Ramsay, *Cities and Bishoprics of Phrygia*, vol. i. (Oxford, 1895); Hermann and others, *Alterthümer von Hierapolis* (Berlin, 1898).

(2) A city in the Glaucus Valley in Central Phrygia (now Kotch-Hissar), which seems to have been the old centre of a pentapolis, and is known in early Christian history from the life of Saint Abercius, or (better) Avircius, a leader in the second century A.D., who caused a remarkable protest against Montanism to be inscribed on his tomb. The original document has survived and is now in Rome. It is so drawn up that it bears a double meaning, and the esoteric Christian sense was clear only to 'him who comprehends.' It has also been interpreted as a heathen document. Consult: Ramsay, *Cities and Bishoprics*, vol. ii. (Oxford, 1897); and Dietrich, *Die Grabschrift des Aberkios* (Leipzig, 1896).

(3) A city of Syria Cyrrhestica, known also as Bambyce (Gk. *βαμβύκη*), situated about twenty-five miles south of the ancient Carchemish, on the hills southwest of the meeting of the Euphrates and Sajur rivers. It is now in ruins, but in the times of the Seleucids was a city of much commercial importance. In the reorganization of the Roman Empire under Diocletian it became the capital of the province of Euphratensis or Commagene. In the time of Justinian it had retrogressed, but the fortifications were restored by the Arabs, and it endured many vicissitudes during the Crusades.

HIERARCHY, hī′ĕr-ärk-ĭ (from ML. *hierarchia*, Gk. *ἱεραρχία*, hierarchy, from *ἱεράρχης*, *hierarchēs*, hierarch, from *ἱερός*, *hieros*, sacred + *ἄρχος*, *archos*, leader, from *ἄρχειν*, *archein*, to lead). The name used by theological writers to designate the whole governing and ministering body in the Church, distributed according to its several gradations. The word, in its strict acceptation is applicable only to the Roman Catholic Church, and to those Christian communities which retain the prelatical form of Church government, or at least the distinctions of ecclesiastical order and gradation. In considing the hierarchy it is necessary to bear in mind the well-known distinction of *order* and of *jurisdiction*. (I.) Considered under the head of *order*, the hierarchy embraces all the various orders or classes of ministers to whom has been assigned the duty of directing public worship, administering the sacraments, and discharging the various other offices connected with the preaching of the gospel; and these are of two kinds—the orders directly instituted by divine authority, and those established by ecclesiastical ordinance. Theologians commonly distinguish a *hierarchy of divine right*, and a *hierarchy of ecclesiastical right*. (1) The first includes the three ranks of bishops, priests, and deacons. The bishops are believed, as successors of the Apostles, to have inherited the integrity of the Christian priesthood. The order of episcopate, however, is not believed to be a distinct order from that of priesthood, but only a fuller and entirely unrestricted form of that order. In all that regards what Roman Catholics believe to be the Christian sacrifice of the eucharist, they hold that the priest possesses the same powers *of order* with the bishop; but he cannot confer the sacrament of orders, nor can he validly exercise the power of absolving in the sacrament of penance without the approbation of the bishop. (2) To the three ranks thus primitively instituted several others have been added by ecclesiastical ordinance. (See Orders, Holy.) (II.) The *hierarchy of jurisdiction* directly regards the government of the Church, and comprises not only all the successive degrees of ecclesiastical authority derived from the greater or less local extension of the several spheres within which such governing authority is limited—beginning with the Pope as primate of the universal Church, and extending to the patriarchs as ruling their several patriarchates, the primates in the several kingdoms as national churches, the metropolitans or archbishops within their respective provinces, and the bishops in their dioceses.

In the Anglican Church, with the office of the episcopate, the theory of a hierarchical gradation of rank and of authority has been retained. The Anglican hierarchy comprises bishops, priests, and deacons. In the other reformed churches a hierarchical government is practically non-existent. Many theological writers, following Dionysius the Areopagite, regard the angels as organized in the same hierarchical manner according to their various orders.

HIERATIC WRITING. See Hieroglyphics.

HI′ERAX, or **HIER′ACOS** (Lat., from Gk. Ἱέραξ). An Egyptian ascetic of the third century. He is said to have lived to the age of ninety, and devoted himself to scientific and literary pursuits. He was the author of biblical commentaries, both in Greek and Coptic, and is said to have composed many hymns. He became leader of the sect of the Hieracites, an ascetic society from which persons living in the married state were excluded. On other points Hierax followed Origen in allegorizing Scripture. From this apparently Manichæan view of matrimony, taken with his denial of the resurrection and of a visible paradise, and his assertion that infants, as incapable of 'striving lawfully,' cannot inherit the kingdom of God, Hierax was regarded as a heretic.

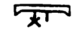
HIERO (hī'ē-rō) **I.** (Lat., from Gk. Ἱέρων). A tyrant of Syracuse, who succeeded his brother Gelo in B.C. 478, having already, a short time before, distinguished himself in the battle of Himera. Being jealous of his brother Polyzelus, who had command of the army, he dispatched him on an expedition against the Crotonians, but Polyzelus fled to his brother-in-law, Theron of Agrigentum. Hiero undertook to make war on the two, but a reconciliation was effected, it is said, by the poet Simonides. Some time after this reconciliation Hiero assisted the people of Cumæ in driving off the Etruscan pirates, by whom they were harassed. He transferred the inhabitants of Naxos and Catana to Leontini, and repeopling Catana with citizens from Syracuse, Gela, and elsewhere, called the place Ætna. After the death of Theron, about B.C. 472, war broke out between Theron's son, Thrasydæus, and Hiero. The former was defeated and compelled to flee from Sicily. Hiero was now supreme in the island. He died, however, shortly after, having reigned ten years. As a ruler Hiero was jealous, cruel, and rapacious; fearing for his life, he surrounded himself with mercenaries and spies. He was, however, a patron of poets and philosophers, and he competed successfully at the Grecian games.

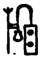
HIERO II. (c.308-216 B.C.). A king of Syracuse, son of a noble Syracusan named Hierocles. He first distinguished himself in the wars with Pyrrhus, and then, after Pyrrhus's departure from Sicily, B.C. 275, in the war with the Mamertines. In consequence of his military successes he was, in B.C. 270, chosen King of Syracuse. In B.C. 264 he assisted the Carthaginians in the siege of Messana, but was himself defeated by the Roman consul, Appius Claudius, and in B.C. 263 concluded a treaty with the Romans, to whom he thereafter remained faithful. In both Punic wars he assisted them with money and troops. During the interval of peace between the two wars he visited Rome and was received with great honors, while he himself on this occasion distributed a vast quantity of corn to the people. Hiero was a wise and merciful sovereign, simple in his ways and just in his rule. We are told that he was prevented from laying aside the kingly power only by the unanimous votes of his subjects. He bestowed great care upon the financial department of his government, and his agricultural laws (*leges Hieronicæ*) were in force in Cicero's time. He was also a patron of the arts, and beautified his city with many fine public buildings. His kinsman Archimedes he employed in the construction of a number of powerful engines of war.

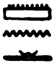
HIEROCLES, hī-ĕr'ō-klēz (Lat., from Gk. Ἱεροκλῆς, *Hieroklēs*). (1) A Greek writer of the sixth century A.D., who composed, under the title *Traveling Companion* . (Συνέκδημος), a work containing a description of the 64 provinces of the Byzantine Empire and of 912 cities in it It is best edited by Burckhardt (Leipzig, 1893). (2) An Alexandrian Neo-Platonist of the fifth century A.D. He wrote a commentary on the Golden Verses of Pythagoras, and a treatise *On Providence and Fate*. Of the latter work only a few extracts have been preserved by Photius, and there is also an anonymous abridgment. The commentary is printed by Mullach, *Fragmenta Philosophorum Græcorum*, vol. i. (Paris, 1875). Under the name of Hierocles we also possess a very old collection of jokes and amusing stories ('Ἀστεῖα), edited by Eberhard (Berlin, 1869).

HIEROCLES OF BITHYN'IA. A Roman proconsul in the reign of Diocletian (A.D. 284-305), said to have been the instigator of the fierce persecution of the Christians under Galerius Cæsar in 303. He was a man of considerable intellectual culture, and wrote a work in two books, in which he endeavored to persuade Christians that their sacred books were full of contradictions, and that in moral influence and miraculous power Christ was inferior to Apollonius of Tyana. This treatise has not come down to our times, and is known to us through Lactantius, and still more through Eusebius, who is the author of a refutation.

HI'EROGLYPH'ICS, or **HI'EROGLYPHS** (Lat. *hieroglyphicus*, from Gk. ἱερογλυφικός, *hieroglyphikos*, hieroglyphic, from ἱερογλύφος, *hieroglyphos*, carver of hieroglyphics, from ἱερός, *hieros*, sacred + γλύφειν, *glyphein*, to carve). The term applied to those systems of writing in which figures of objects take the place of purely conventional signs, and especially used to designate the writing of the Egyptians and Mexicans. The system of Babylonia (whence the cuneiform writing developed) and that of China were likewise originally picture-writings, but were very early simplified and conventionalized, and thus lost their hieroglyphic character. These two systems present so many striking analogies to the Egyptian that a connection is often assumed, but these analogies appear merely to afford an illustration of the tendency of the human mind to run, under certain conditions, in the same channel, and this view is strengthened by some analogies from American pictographs and hieroglyphics. Hieroglyphic systems are also represented by the monuments of the Hittites and the early Cretans, both as yet undeciphered; an Egyptian origin would, in these cases, be less improbable than in the cases of Babylonian and Chinese characters. The Phœnician alphabet cannot be proved to descend from a hieroglyphic system; the names of the letters (ox, house, etc.) seem to have been merely mnemotechnic helps for learners. The Egyptian system is the most remarkable of all, because it always retained the most primitive form, although developing to a high degree of philological perfection. It is impossible to trace this system back to its origin in descriptive pictures; such pictures, for example, as the North American Indians sometimes used for communications, though without developing a real writing. The very earliest monuments of Egypt, anterior to Menes, the first historical king, exhibit the system already perfected, differing in many details from the later orthography, but what were then the principles are the same as at all later periods. The invention must therefore belong to a very remote age.

The most primitive part is represented by the so-called ideographs or word-signs. Some of these are shown in the accompanying illustrations. It is very easy to represent a man (*romet*), a woman (*himet*). Both taken together mean 'mankind'; one repeated three times, 'men' or 'women.' A soldier is easily characterized by his arms and costume; a chief by his staff; a king by the addition of the crown; a child (*khrod*). by sucking its finger. Animals can be figured to a large extent, also some plants, the parts of the human body, etc. But wood (*khet*) can be represented only by a twig ; grain (*yot*) by three grains ; water (*mou*) by wavy lines From indications of this nature there is but a step to symbolism. 'Hearing' (*sotem*) is expressed by the ear of an ox , while the human ear means only 'ear'; 'weeping' (*remy*) by a weeping eye ; 'drinking' by a man drinking (the arm and bowl alone suffice). 'Fighting battle' is symbolized by weapons 'going' by a pair of legs ; 'returning' by an inversion of this sign; 'bringing' (*eny*) by a vessel, in combination with the sign for 'going' ; 'giving' (*day*) by an arm presenting a cake . 'Rain' can, of course, be easily represented by a sky with water falling from it ; but the ideas 'night,' 'darkness,' must be symbolized  by a star hanging from the sky; 'cool' (*qohh*) is indicated by a water-sprinkler . A great many words and ideas, however, cannot be represented at all, and here the writer surmounts the difficulty by using the signs for homophonous words or for words of somewhat similar sound, exactly as such signs are employed in our modern rebus. For example *khun*, *khen*, 'inside, in,' and *kheny*, 'to approach,' have no etymological connection whatever with the pictorial sign for 'hide,' 'skin' (*khen*) , but the same picture is used for all three words. Thus many signs pass from the ideographic into the phonetic class, that is, they merely represent sounds without regard to the meaning, and from word-signs they develop into syllabic signs of two consonants (for example, the figure of the hide becomes the syllabic sign *khn*, representing any syllable with the two consonants kh and n); a few signs finally obtain the value of single consonants and form the alphabet.

The rebus system, however, would have led to many obscurities. Some inscriptions, indeed, simply use the sign for *khn* for all three words, and leave it to the reader to decide from the context whether 'skin,' 'in,' or 'approach' is meant. The majority of scribes, however, use as helps the so-called determinatives. For example, they place after the sign *khn* the hieroglyph for 'house' to indicate that it means 'within,' and distinguish the word 'approach' by the addition of a pair of legs, indicating a verb of motion. Again  (writing implements) means 'writing,' 'write,' 'scribe,' but by applying the proper determinatives, the writer can readily indicate which of these meanings he wishes to convey. By placing after this sign the figure of a man he makes it clear that 'scribe' is intended, while the addition of a roll of papyrus indicates that 'writing,' 'book,' is meant. These determinatives are not arbitrary, but are used in accordance with certain fixed principles. Thus all words for quadrupeds which cannot be easily represented are written phonetically, and determined by a piece of skin; all names of persons are determined by the figure of a man or woman; all names of trees by a tree ; small plants by ; drugs, sand, etc., by round grains ; actions of the mouth (eating, speaking, etc.); or thought by ; violent actions by a man or an arm in the act of striking ; localities by a house, etc. To these determinatives belongs also the so-called cartouche (q.v.) or frame surrounding royal names. Perfectly analogous determinatives are found in Babylonian (where, however, they are rather sparingly employed), and in Chinese.

A great many of the ideographs are polyphonous, that is, they admit of more than one pronunciation; as, for example, the picture of a horse might be understood by an Englishman as standing for 'horse,' 'steed,' 'mare.' To prevent such ambiguity, many signs receive what is called the phonetic complement. For example, the sign *mn* (originally representing a chess-board) is very rarely used alone; an *n* is generally placed after it to fix the pronunciation. Therefore, *men*, 'to remain,' is usually written  i.e. the syllabic sign *mn* + the phonetic complement *n* (not to be pronounced separately) + the determinative 'book,' indicating that the word belongs to the category of abstract ideas. In classical orthography, many signs are invariably followed by a phonetic complement. With some signs the phonetic complement precedes, while others have two or even three complements. For example, the word *seshem*, 'to lead,' is always written *s* (phonetic complement); the word-sign *sshm* + *m* (second phonetic complement) + the determinative of a verb of motion. Thus arises a very complicated but quite regular orthography, which is of special service to the reader in that it enables him to distinguish between the different values of the polyphonous hieroglyphs. The sign 'star,' for example, may be read *sb* or *dw;* if the latter reading be intended a *w* follows as phonetic complement, while for the former reading an *s* is prefixed. Word-signs having several synonymous values do not always have phonetic complements. The reader, for example, may be left to discover from the context whether the sign 'horse' is to be read *sesem*, 'horse,' *sesmet*, 'mare,' *nofer*, 'colt,' etc. The sign ⊙ (the sun) may be understood as 'day' (*hrow*), or as 'sun' (*rê*).

The alphabet developed from signs for very short words containing only one firm consonant. The opinion of the first decipherers, that the alphabet was acrophonic—that is, that the phonetic value of each letter was taken from the initial sound of the word represented by its sign—has not been confirmed. The alphabetic signs ought. of course, to be the latest element of the system, but we find them fully established on the earliest monuments, so that they certainly go back to the fifth millennium B.C. The Egyptian alphabet is as follows:*

(1) 𓄿 The Semitic Aleph ('), i.e. the general indication of a vowel beginning a syllable; later treated as a vowel.

(2) 𓇋 (A reed leaf) *y*, as a consonant; at a very early period confounded with the preceding letter. and later distinguished from it by doubling. Thus in the later orthography a single reed-leaf stood for Aleph, a double reed-leaf for the consonant *y*.

(3) 𓂝 (An arm, *ê*), the Semitic guttural Ain.

(4) 𓅱 *w* or secondarily *u;* later variant 𓏲 from about 1500 B.C.

(5) 𓃀 *b*.

(6) □ or more elaborately ■ *p* (representing a mat?).

(7) 𓆑 *f* (representing a viper or snail).

(8) 𓅓 *m* (an owl); later variant 𓐝

(9) 𓈖 *n* (water); later variant 𓋔.

(10) 𓂋 *r* (*ro*, 'a mouth').

(11) 𓉔 *h* (*hay*, 'a hall').

(12) 𓎛 h; (a rough *h;* the lighter sound of Hebrew Kheth, Ḥeth).

(13) ● *kh;* (the Scotch and German guttural *ch*).

(14) 𓄡 *h* (similar in sound to the preceding, but somewhat softer). The sign originally stood for *hêt*, 'a belly,' and represented an animal cut open; the form here given is partially conventionalized.

(15) 𓊃 *s* (originally different from the following, but soon after 3000 B.C. confounded with it). The sign represented a door-bolt.

(16) 𓋴 *s* (sharp *s;* early confused with the preceding).

(17) 𓈙 *sh;* a conventional representation of a lake (*Shei*).

(18) 𓈎 *q*. Hebrew Koph, Qoph, a guttural *k*. The sign represents a hill (*qay*).

(19) 𓎡 *k*. It represents a working-basket (*kay?*).

(20) 𓎼 *g*.

(21) 𓏏 *t*. Perhaps another kind of basket, or a vase.

(22) 𓍿 *t*, a sibilant dental which is usually assumed to have been *th* or *z*, but seems to have been quite a peculiar sound. It was later commonly pronounced *t*.

(23) 𓂧 *d*.

(24) 𓆓 *z*, or more correctly the Hebrew emphatic *s* (Sade).

In later times the variants increased considerably, as the scribes were continually inventing new and playful forms of the letters; in Roman times hundreds of signs were in use for the alphabet, but several of the original sounds were lost or confused in later pronunciation. However, down to B.C. 1000 the variants enumerated above were the only ones, and all these sprang up after B.C. 1600. It will be observed that originally the letters expressed only the consonants, and the vowels were, with the exception of a few vague indications, left for the reader to fill in, exactly as in unpointed Hebrew or Arabic. The group *hbs*, for example, may be read *hobs*, *hbos*, *hebos*, etc. Later orthography attempted to express the vowels in certain cases, especially in foreign names which demanded a more exact notation, but neither consistently nor successfully. All this adds greatly to the difficulties of the Egyptologists. They have not only to supply the vowels from Greek and other traditions, from the corresponding Coptic words, from variants, etc., but they must also reckon with the tendency of the Egyptian scribes to abbreviate and to omit consonants, where they were supposed to be readily supplied by the reader. For example, *henqet*, 'beer,' is always spelled *hqt*. See, however, below on the present degree of certainty of reading. Foreign names and words were, in the time of Dynasties 18-22. written in a strange orthography called the syllabic system. The vowels were copiously expressed by placing syllabic signs for every consonant, even where no vowel followed. For example, the Palestinian name of a city, *Shalem*, was spelled: *Sha-ra-ma*, the word *markabt*, 'chariot,' *ma-*(*i*)*ra-ka-bu-ti*, etc. This wild heaping of vowels is of little advantage to the reader, and has led to many errors.

The hieroglyphics were commonly written from the right to left; more rarely from left to right. On early monuments they are frequently written from above downward, like the earliest Babylonian and Chinese writing; the arrangement called *boustrophedon* by the Greeks is never met with. The number of signs is, in a certain sense, unlimited, as the artist could vary the details of each hieroglyphic according to his individual taste. But the sculptors did not greatly abuse this liberty, and usually kept within the bounds of intelligibility. As a matter of fact, the signs commonly used are only from five to six hundred in number. The artists found full play for their fancy in the minor details of execution; in the case of some magnificent buildings, they have actually designed and painted every feather of a bird, every finger of a human figure, etc., in inscriptions containing many thousand signs. The decorative effect of the brightly painted signs is exquisite. In other cases, however, when the sculpture had to be inexpensive, the signs were reduced to the simplest possible forms; in cheap funerary inscriptions they are often mere indications of figures, and their recognition calls for all the skill and ingenuity of the trained reader.

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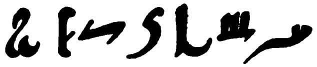
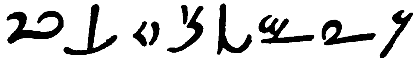
*The arrangement is, of course, modern; explanations are added only where they are quite certain.

While in monumental use the pictorial character of the hieroglyphs always remained distinct, in the writing of books this was not the case. Here a simpler, more rapid method of writing was required, and even on the monuments of the First Dynasty we find the hieroglyphs simplified to a few strokes, where the pen is used instead of the chisel. On papyrus the writing soon assumed a cursive character, bearing no closer resemblance to the original pictorial hieroglyphs than our cursive script bears to our printed letters. The cursive style thus developed was called by the Greeks 'hieratic,' or the style for sacred writings, in contradistinction to the demotic character (see below), which was exclusively employed for profaner matters. This cursive style is found on the earliest books which have been preserved (dating from Dynasty 5). To give an idea of hieratic, we reproduce here the first seven letters of the alphabet (without variants) in the cursive style of about B.C. 1400.



One can still recognize the original form of the arm, the *b* (leg), and the *f*, but the two birds have become mere flourishes in which only the boldest fancy can detect a resemblance to the original pictures. Of course, this style of writing changed more than the monumental forms, and every century had its marked peculiarities. The Greek name must not be misunderstood: all literature, secular and religious, history, novels, love songs, business documents, letters, used the more convenient rapid style. Only funerary texts are frequently written in a simplified hieroglyphic character. It was only after the demotic had become prevalent that hieratic was reserved for books of a religious character (after B.C. 600). Hieratic runs from right to left like most Oriental writings; in the earliest times, however, it was sometimes written perpendicularly.

Demotic, or popular writing, is a later development of hieratic. The Egyptians themselves called it 'the documental or epistolary style,' as it seems to have been developed in the law courts and offices where the necessity of tachygraphy led to constant abbreviations, until finally a real stenography resulted. Its origin goes back to the seventh century B.C. In B.C. 400 it had assumed a convenient form, and came into general use, so that the Greeks found it employed for everything except religious literature (see above), and called it, therefore, the demotic (the common, popular) style or the enchorial (the writing of the country). In Roman times even religious texts were frequently written in demotic. As specimens we give here the same seven letters of the alphabet which were reproduced above in hieratic. The second of these characters is more commonly represented by a single vertical stroke. It will be observed that two forms of the letter *p* are given, of which the first is more elaborately formed. The sign representing a crouching lion was reduced to a slanting stroke, etc. Whole groups of five or six hieratic signs were combined in a single flourish. Thus the writing became rapid enough to equal in speed our modern writing and the stenographic systems of the Romans; but its study was complicated and it became unintelligible where not written very distinctly. The number of demotic signs was smaller than that of hieratic (not over two hundred). Like hieratic, demotic was written from right to left. It is a common error to suppose that demotic means 'popular language'; the term properly designates a style of Egyptian writing, and a phase of the language, although documents written in the demotic script are usually composed in a later form of Egyptian. The Egyptian language, of course, underwent great modifications in course of time; the language of the earliest texts known to us—the religious texts in the pyramids—seems to have offered great difficulties to the Egyptian scholars of about B.C. 2500.



The use of the contemporary vernacular language was rarely allowed in literature, and in general the hierogrammates (sacred scribes) sought to write in as archaistic a style as possible. After B.C. 1600 they found it more and more difficult to write the old language correctly, and from about B.C. 1400 to 1100 the living vernacular language was used for letters, legal documents, and entertaining literature. The language of this period, the so-called Neo-Egyptian, has been treated by Erman, in his *Neuägyptische Grammatik* (Leipzig, 1880). After B.C. 1000 the scribes reverted to an exaggerated archaistic style, and the texts became more and more ungrammatical; the barbarous age began after B.C. 500, and in Roman times the monumental texts are so wild in grammar and orthography that their decipherment is especially difficult. In demotic literature a mixture of ancient and modern language prevailed. The vernacular language finally came into literary use in Roman times through the influence of Christianity. The heathen and their priests continued to write hieroglyphics on the monuments, hieratic and demotic on papyrus, almost to the end of heathenism. The last datable hieroglyphic inscription is found in the Temple of Esne (q.v.), and contains the name of the Emperor Decius, A.D. 250. A demotic inscription at Philæ (where paganism lingered on after the edict of Theodosius, A.D. 379) is dated in the year A.D. 453. Even later, some sporadic knowledge of the old writing may have existed, but, stamped with the reproach of heathenism, it soon sank into oblivion.

Some attempts to write the living language in the Greek alphabet, supplemented by some demotic signs, had been made in pagan times, and we possess a papyrus, containing a horoscope, which seems to have been written about A.D. 100. It was, however, the desire to make the sacred Christian writings accessible even to the unlearned that led to the origin of Coptic writing and literature. The date of the Coptic version of the Bible is disputed, but it does not seem to be older than the third century, perhaps later. Coptic was written with 24 Greek and 7 demotic letters. On its history and its extinction as a living language at the end of the Middle Ages, see Copts.

Interest in the lost knowledge of hieroglyphics was awakened in Europe in the sixteenth century. About 1650 the learned Jesuit Athanasius Kircher endeavored to interpret them by a fanciful method of his own, finding long theological and philosophic systems in groups which contained only the names of kings, etc. The few monuments with hieroglyphics which were then known were explained by means of Hebrew, Chaldee, Chinese, etc., rarely by means of Coptic, which was known only imperfectly in Europe before the eighteenth century. The Greek traditions on hieroglyphics in Horapollo, Tsetses, etc., were not incorrect, as has now been recognized, but insufficient. The basis for decipherment was furnished by the French expedition to Egypt under Napoleon. Through it a much larger number of the Egyptian monuments became known, above all the famous inscription of Rosetta, which proved the key to the decipherment. This stone, found by a French artillery officer in building a fort near Rosetta in 1799, and brought to London after the capitulation of the French army (see Rosetta Stone), contains a decree of the Egyptian priests in honor of Ptolemy V., Epiphanes, written in Greek, and preceded by a translation into hieroglyphics and demotic. Unfortunately, the hieroglyphic text was much mutilated, and for some time defied the efforts of the decipherers. The demotic part was better preserved and De Sacy, Ackerbald (1802), especially Thomas Young (1815, etc.), correctly established the sense of many groups and sentences. Dr. Young came very near finding the correct value of some hieroglyphic letters (1819), but the merit of the decipherment belongs entirely to Champollion (q.v.), even if he did not work quite independently of Young, as he always claimed. He took as starting-point the two names Ptolemy and Cleopatra, furnished by the Rosetta Stone and an obelisk at Philæ. These two names yielded thirteen signs, the phonetic value of which Champollion determined correctly or approximately. He next identified the name Alexander, which furnished three more signs, and thus went on step by step, through the names of the Ptolemaic kings and Roman emperors found on the monuments, and if he had not died prematurely (1832) he would doubtless have succeeded in reading more than single sentences and in perfecting his system, which even in his posthumous works does not do full justice to his genius. His discoveries were continued by Rosellini, Salvolini, later by Birch, Lepsius, and De Rougé. For a long time the errors of Seyffarth and Uhlemann exercised a confusing and hindering influence. The French and Tuscan expeditions under Champollion and Rosellini, and especially the Prussian expedition under Lepsius (q.v.), furnished rich material from the monuments. Grammars of the language of the hieroglyphics were published by De Rougé (*Chrestomathie égyptienne*, Paris, 1867-75); Birch (in Bunsen, *Egypt's Place in the World's History*, trans. vol., London, 1887); Brugsch, *Hieroglyphische Grammatik* (Leipzig, 1872), also in French (1867). Later grammars by Lepage Renouf, *Elementary Grammar of the Egyptian Language* (London, 1875); Budge, *First Steps in Egyptian* (London, 1895); Loret, *Manuel de la langue égyptienne* (Paris, 1889). Erman's book, *Aegyptische Grammatik*, also in English (London, 1894), is very brief, but best represents the present knowledge. On his grammar of Neo-Egyptian, see above; his *Sprache des Papyrus Westcar* (Göttingen, 1889) treats of an early vernacular phase of the language. A copious dictionary is in preparation under the auspices of the Berlin Academy, as Brugsch's *Hieroglyphisch-demotisches Wörterbuch* (7 vols., Leipzig, 1867-80), although the best Egyptian dictionary at present in existence, is rapidly becoming antiquated. The dictionaries of Birch (in Bunsen V.), Pierret, *Vocabulaire hiéroglyphique* (Paris, 1875); Levi, *Vocabolerio geroglifico copto Ebraico* (Turin, 1887), are less reliable than that of Brugsch. Several journals are devoted to Egyptology, viz.: *Zeitschrift für aegyptische Sprache und Altertumskunde* (Berlin); *Recueil de travaux rélatifs à la philologie et à l'archéologie égyptiennes et assyriennes* (Paris); *Sphinx* (Upsala); and the literature of the subject is growing immensely. The success which attended the study of hieroglyphics attracted the attention of students to this branch of Egyptology, and demotic was for a long time neglected. In 1855 Brugsch published his *Grammaire démotique*, which, though now antiquated, formed the basis for all subsequent investigations. Again neglected for a considerable time, the study of demotic was revived by Revillout, who devoted special attention to the legal documents written in demotic script (*Chrestomathie démotique*, Paris, 1880), but his works are to be used with great caution. In more recent times, the most meritorious publications on the subject of demotic are those of F. Ll. Griffith and W. Spiegelberg. The hieratic documents were first made intelligible by the works of Chabas and Goodwin. The paleography of hieroglyphics has recently been treated by Griffith in several volumes of the Archæological Survey of Egypt. (See Egyptology.) It may be remarked that the question as to whether the decipherment of Egyptologists rests on a better basis than the vagaries of Kircher was frequently asked as long as the fragmentary Rosetta Stone was the only bilingual (or rather trilingual) text. After the discovery of the larger and perfectly intact trilingual text, called the decree of Canopus, containing a decree of the priests in honor of Ptolemy III., Euergetes, in the year B.C. 238 (found by L. Reinisch, 1886, near Tanis; his companion Lepsius also claimed the discovery), such doubts became impossible. Since that time various bilinguals have been found, and other sources which control the decipherment are now available. The exact pronunciation of the vowels, which were never perfectly expressed in Egyptian writing, and changed frequently in course of time, is much disputed, and will possibly never be settled with absolute certainty in all points. The texts, however, are now, generally speaking, at least as well understood as any Phœnician inscription or as the Hebrew text of the Bible. The time when they will be understood as well as Greek or Latin writers may not be far distant. That the Phœnician alphabet, the mother of our modern writing, was derived from the Egyptian hieratic signs was claimed by De Rougé (*Mémoire sur l'origine égyptienne de l'alphabet phénicien*, Paris, 1874), and this hypothesis has become very popular; it is, however, highly improbable and is losing ground among scholars.

Much less perfect was the hieroglyphic writing of the Aztecs or Mexicans, which was used also in Central America, especially by the Mayas. Unfortunately, the literature written in those hieroglyphs was destroyed so thoroughly by the Spanish priests that only a very few manuscripts (preserved in Rome, Dresden, etc.) have survived, besides a few inscriptions on stone. The Spanish writers of the sixteenth century have left the explanation of a few signs only, so that the Aztec writing is almost entirely unintelligible. However, what we understand of it seems to show that the Mexicans did not advance much beyond the pictographic stage, though the pictures they used were highly conventionalized. They could express the names of persons, places, months, etc., by painting the objects or beings after which they were called, and went so far as to use symbolical signs of plants and animals, to express grammatical forms so that their pictures were not read, but interpreted. Where, for example, they recorded historical events, they had to picture these, as the inscriptions alone would have been insufficient. The majority of their books seem to have been calendars, lists of omina, etc., for which their imperfect writing system sufficed. It is said that some Spanish monks made use of hieroglyphic signs for expressing Latin prayers. For example, they are said to have expressed the words *pater noster* by a flag (*pantti* = *pa*), a stone (*tetl* = *te*), a cactus-fruit (*nochtli* = *noch*), and a stone (= *te*, see above). Rude as this system seems, it marked, nevertheless, a step in advance, as the hieroglyphs from word-signs became phonetic signs. Such attempts, however, remained perfectly isolated; the Spanish missionaries usually showed the greatest hostility to anything recalling the former Aztec idolatry. The term hieroglyphic was used by the writers of emblemata or devices, symbolizing gnomic sentences taken from the Greek and Latin poets, and having no relation to Egyptian hieroglyphics. In recent times, also, the astrological almanacs have had their symbolical representations and supposed prognostics of future events, which they called hieroglyphs. Consult Brugsch, *Aegyptologie* (Leipzig, 1891); Berger, *Histoire de l'écriture dans l'antiquité* (Paris, 1891); Erman, *Life in Ancient Egypt* (London, 1894); Lepsius and Stern, *Liste der hieroglyphischen Typen aus der Schriftgiesserei des Herrn F. Theinhardt* (Berlin, 1875); Von Lemm, *Aegyptische Lesestücke* (Leipzig, 1883); Erman, *Egyptian Grammar* (London, 1894); Levi, *Raccolta dei segni ieratici egizi* (Turin, 1880); Erman, *Die Märchen des Papyrus Westcar* (part ii., Berlin, 1890); Brugsch, *Grammaire démotique* (Paris, 1855); Hess, *Der demotische Roman von Stne Ha-m-us* (Leipzig, 1888); Revillout, *Chrestomathie démotique* (Paris, 1880).

HIERON, hī'ĕr-ŏn. The name of two rulers of Syracuse. See HIERO I. and II.

HIERONYMITES, hī'ĕr-ŏn'ī-mīts. The common name of four associations of hermits in Spain and Italy, who all regarded Saint Jerome as their patron and example, and hence derived their name. (1) The Spanish congregation founded in the reign of Alfonso XI. of Castile (1312-50) by some disciples of Tommasuccio of Siena, a hermit who had considerable following in Northern Italy and observed the Franciscan rule. Their two earliest settlements were in the mountains near Toledo. Their numbers soon grew, and included many persons of rank and station, such as Ferdinand Pecha, principal chamberlain to Pedro IV., and his brother Alfonso, Bishop of Jaen. The former obtained confirmation for their association from Gregory XI. in 1373, under the rule of Saint Augustine, and is regarded as the real founder of the Order. By 1415 they had twenty-five cloisters, among them that of San Gerónimo de Yuste, in which the Emperor Charles V. passed his last years. That of Belem, near Lisbon, became the burial-place of the Portuguese royal family. A female branch of the Order was founded by Maria Garcias (died 1426). (2) The congregation of the Observance or of Lombardy, founded by the Spaniard, Lope de Olmedo (1370-1433), who became general of the foregoing Order in 1422. His purpose in establishing a separate congregation was the attainment of still greater strictness. The rule which he drew up was confirmed in 1429, but after his death was exchanged for that of Saint Augustine. The seven Spanish cloisters of the Order were in 1595 united by Philip II. with the foregoing, but the seventeen Italian retained their separate existence under a general residing at Hospitaletto, near Lodi. (3) The congregation of Peter of Pisa (Pietro Gambacorta, 1355-1435), who turned from a worldly to a hermit's life in 1377 and built a church and hermitage on Montebello, near Urbino. Several small communities of Franciscan tertiaries associated themselves with him; the principal settlements were at Vicenza and Mantua. Only simple vows were taken until 1569; but Pius V. imposed the solemn vows and the Augustinian rule. The Order had at one time over fifty houses, including one founded at Walchensee in Bavaria in 1688, and removed to Munich in 1725. (4) The congregation of Fiesole, founded by Carlo di Montegranelli and confirmed by Innocent VII. in 1406. It came to possess more than forty houses, including the Convent of Saints Vincent and Anastasius in Rome, but was suppressed as a separate organization by Pope Clement IX. in 1688.

HIEROPHANT, hī-ĕr'ō-fănt (Lat. *hierophanta*, *hierophantes*, from Gk. ἱεροφάντης, *hierophantēs*, hierophant, from ἱερός, *hieros*, sacred + φαίνειν, *phainein*, to show). The head of the secret worship of Demeter, at Eleusis, who at the celebration of the mysteries showed the sacred objects and explained the ceremonies. He was required to be one of the old priestly family of Eleusis, the Eumolpidæ, and probably was prohibited from holding any other office. With him was associated a hierophantes, or possibly two. The hierophant was required to be of mature age and clear voice; he seems to have held the office for life, but the statement that celibacy was required is of doubtful value. The hierophant laid aside his own name on assuming his office, and henceforth was known only as Hierophantes, though his father's name and his deme are appended as in the case of personal names. His costume was that usually worn by kings in tragedy. Consult Foucart, *Les grands mystères d'Eleusis* (Paris, 1900). See Mysteries.

HIEROSOLYMA, hī'ĕr-ō-sŏl'ĭ-mȧ. See Jerusalem.

HIG'DEN, Ranulf (?-1364). An English chronicler and monk of the Benedictine Order. A native of the west of England, he entered Saint Werburgh's monastery at Chester, in 1299, and is remembered chiefly for his *Polychronicon*, a synopsis of which was printed by Caxton in 1480, and in an English translation two years later. It is a universal history in seven books, extending down to Higden's own day and giving an excellent general idea of the learning of his time. The events after 1342 are recorded by other pens, and the whole has been edited and translated for the "Rolls Series" (9 vols., 1865-86).

HIG'GINS, Anthony (1840—). A United States Senator, born at Red Lion Hundred, Del. He graduated at Yale in 1861; studied at Harvard Law School, and in 1864 was admitted to the bar. From 1869 to 1876 he was United States Attorney-General for Delaware, and in 1881 received the Republican vote of the Delaware Legislature for United States Senator. In 1889 he was elected to the Senate, his term of office expiring in 1895.

HIGGINS, Matthew James (1810-68). An English essayist and pamphleteer; often called by his pen-name Jacob Omnium. He was born at Benown Castle, and was educated at a school near Bath, at Eton, and at University College, Oxford, where, because of a preference for hunting, he never graduated. In 1847 he became an ardent Peelite, and wrote for the *Morning Chronicle*. In 1850 he married Mrs. Benett, née Tichborn, and moved to London, where he became a popular club man. He was most famed for his letters to the *Times*, over such signatures as 'Paterfamilias,' 'Mother of Six,' and 'A Thirsty Soul,' in which he exposed many abuses; for his dispute with the *Times* in connection with Major Crawley and his court-martial, and for his contributions to the *New Monthly Magazine*, where he first appeared as 'Jacob Omnium' in a satire on mercantile dishonesty; for his essays to the *Edinburgh Review*, the *Cornhill*, under the editorship of his friend Thackeray, and to the *Pall Mall Gazette*. Several of his essays were reprinted under the title, *Essays on Social Subjects* (1875), with a memoir by Sir William Stirling Maxwell.

HIG'GINSON, Francis (1588-1630). An English Puritan clergyman, and one of the first ministers of Salem, Mass. He graduated M.A. at Cambridge University, England, in 1613; received his first charge in the Anglican Church in Claybrooke, Leicestershire, two years afterwards, and later was appointed preacher at Saint Nicholas, Leicester. He, however, became a Nonconformist, and was suspended about 1627; but continued working among his parishioners as a lecturer, and as a tutor to young men preparing for a university course, until, proceedings being instituted against him in the high commission court, he applied for a position as minister to one of the settlements of the Massachusetts Bay Company. He arrived at Salem in June, 1629, and was appointed assistant minister to Samuel Skelton, but died fourteen months later, August 6, 1630. He was author of "A True Relation of the Last Voyage to England, etc., written from New England, July 21, 1629," printed in ch. xi. of Young's *Chronicles of the First Planters*, etc. (1846); and of *New England's Plantation, or a Short and True Description of the Commodities and Discommodities of that Country* (3d ed. London, 1630). Consult: Felt, "Life of F. Higginson," in *Annals of Salem* (Boston, 1845); and Higginson, *Life of Francis Higginson* (New York, 1891).

HIGGINSON, Thomas Wentworth (1823—). An American essayist, born in Cambridge, Mass., of a distinguished New England family. He graduated at Harvard in 1841, and after some teaching at the Divinity School there in 1847, he took pastoral charge of the Congregational Church in Newburyport; but he left this because of anti-slavery convictions in 1850, when he was an unsuccessful candidate for Congress. After a six years' pastorate in Worcester, Mass. (1852-58), he left the ministry, was active in the anti-slavery agitation, especially in Kansas, served with distinction in the Civil War as colonel of the first regiment of freed slaves, was wounded in 1863, and, after peace, devoted himself to literature, education, and the political rights of women. He resided till 1878 in Newport, but afterwards he made his permanent home at Cambridge. His works have lately been published in a uniform edition. Among the more noteworthy of many volumes are: *Outdoor Papers* (1863); *Malbone, an Oldport Romance* (1869); *Army Life in a Black Regiment* (1870); *Atlantic Essays* (1871); *Oldport Days* (1873); *Young Folks' History of the United States* (1875), translated (French, 1875; German, 1876); *Short Studies of American Authors* (1879); *Common Sense About Woman* (1881); *Life of Margaret Fuller Ossoli* (1884); *Larger History of the United States* (1885); *The Afternoon Landscape; Poems and Translations* (1889); *Concerning All of Us* (1892). His later volumes, beginning with *Cheerful Yesterdays* (1898), continued by *Old Cambridge* (1899) and *Contemporaries* (1899), have mainly dealt with the interesting generation of which he is almost the sole survivor. His latest volume (1902) is a memoir of Longfellow. As an essayist he is noted for his consistent defense of things American, and for his epigrammatic power of expressing thoughts that are often as subtle as they are convincing. Higginson's collected works were published in 7 vols. in 1900. Consult Bentzon, "Un Américain représentatif—Thomas Wentworth Higginson," in *Revue des Deux Mondes* (Paris, 1901), and translated in book form, 1903.

HIG'GINSVILLE. A city in Lafayette County, Mo., 55 miles east of Kansas City; on the Missouri Pacific and the Chicago and Alton railroads (Map: Missouri, C 2). A State Confederate Home is situated here. The city is of importance as a grain, poultry, and coal market, several coal-mines being operated in the vicinity, and has flour-mills, machine-shops, brick-works, a large beehive-factory, etc. The water-works and electric-light plant are owned by the municipality. Population, in 1890, 2342; in 1900, 2791.

HIGHBINDERS (probably *high*, in slang sense + *binder*, variant of *bender*, spree). A name used in California to designate the disorderly and dangerous Chinamen domiciled there. They are not connected with the Six Companies (q.v.), nor are they regularly organized, but act in an irresponsible, lawless way for and among themselves. They are men without definite occupation, living as best they can upon the Chinese communities, as keepers of evil resorts, gamblers, parasites upon prostitutes, thieves, and criminals generally. The name was originally applied to any rough, and was in use in New York and Baltimore as early as 1849, but has gradually become restricted to its present application.

HIGH COMMISSION, The Court of. An extraordinary tribunal, famous in English history, originating under the Act of Supremacy during the first year of Elizabeth's reign, which authorized the Queen to appoint an ecclesiastical commission to reform or correct all "heresies, errors, schisms, abuses, contempts, and enormities whatsoever." In July, 1559, Elizabeth granted a commission to "Matthew Parker, nominate Bishop of Canterbury, and Edmund Grindall, nominate Bishop of London," with seventeen laymen, constituting them a court for the whole realm. The court might proceed by witness, with or without a jury, or in any way it should deem proper. It might compel attendance on mere suspicion, examine either the witnesses or the accused "upon their corporal oath," and commit them to 'ward' for disobeying its summons or any of its decrees.

The tribunal was created primarily to administer the Acts of Supremacy and Uniformity. As already seen, this first commission authorizes the use of the oath *ex officio*, through which the accused might be forced to convict himself. "This procedure, which was wholly founded on the canon law, consisted in a series of interrogations so comprehensive as to embrace the whole scope of clerical uniformity, yet so precise and minute as to leave no room for evasion, to which the suspected party was bound to answer" upon his 'corporal' oath. According to Strype, the oath *ex officio* was the ground of much of the popular hatred of the High Commission. That tribunal was regarded as a kind of ecclesiastical star chamber; and, in fact, the relations of the two bodies were very close. The real activity of the High Commission began in 1583 on the succession of Whitgift to the office of Archbishop of Canterbury. It was maintained with increased powers during the reigns of James I. and Charles I.; but, hated by the people and opposed by the law courts, with the Star Chamber it was abolished by the Long Parliament in 1641. It was restored in a modified form by James II. in 1686, but was definitively abolished in 1688. The commission issued by Elizabeth authorized the commissioners to act throughout the whole kingdom; but in practice their jurisdiction was restricted to the Province of Canterbury or Southern England. "There is evidence to show that during, at all events, the greater part of the period 1559-1640, a northern commission was sitting at York, Durham, Ripon, or elsewhere, and discharged functions analogous to those discharged by the southern commission at Lambeth, Fulham, Croydon, or Canterbury" (Prothero, *Select Statutes*, xlv.). There was also a commission for Ireland, and until 1606 commissions were sometimes issued for particular dioceses. The text of the principal commissions and other documents may be found in Prothero's *Select Statutes* (Oxford, 1894). Consult also: Hallam, *Constitutional History* (new ed., London, 1876); Strype, *Annals* (4 vols., new ed., Oxford, 1824), vol. iii.; Burn, *The Star Chamber: Notices of the Court and Its Proceedings, with Notes on the High Commission;* Gardiner, *Report of Cases in the Court of Star Chamber and High Commission, 1631-32*, in Camden Society, new series, vol. xxxix. (Westminster, 1886); and the histories of Green, Ranke, and Gardiner.

HIGH COURT OF JUSTICE. The division of the English Supreme Court that has general original jurisdiction. It was created by the Judicature Acts (q.v.).

HIGHER CRITICISM. See Biblical Criticism.

HIGHER LIFE, The. A name given to an advanced state of grace which many persons claim may be reached in this life. It is also called entire holiness, full salvation, and Christian perfection. The doctrine has various forms. (1) Complete sinlessness may be reached by a single act of complete consecration to God, continuing according to some during life, according to others for indefinite periods. The objection to this claim is twofold. Complete sinlessness does not seem to be established as a fact. Nor is any previous state, founded on a consecration of self to God which is less than complete, truly a Christian state at all. (2) The state is one of perfection of Christian love, by grace made supreme in the soul. Most sin would necessarily be excluded by such a love, and errors that were objectively wrong would not be subjectively sins, because not intended as such. The question as to this form of the doctrine is one of fact. Is there reason to believe that given individuals are thus under the domination of uninterrupted, perfect love? (3) The state is attained by conformity to the actual demands of God, which are lowered from the strict standard of ideal perfection to meet the capacity of our feeble natures. This theory confounds the standard of conscience and the demands of God with what may be effected as a rational probability that men shall attain. Consult Johnson, *The Highest Life* (New York, 1901).

HIGH'GATE. A northern, hilly section of metropolitan London, in Middlesex, 5 miles north-northwest of Saint Paul's (Map: London, C 7). It commands a fine view of the city, comprises many elegant villas and historical residences, and is the seat of important benevolent institutions. The Highgate or North London Cemetery contains the graves of numerous celebrities, including Lord Lyndhurst, George Eliot, Coleridge, and Faraday.

HIGH-HEELS AND LOW-HEELS. The two political parties of Lilliput, in Swift's *Gulliver's Travels*. They are so called from the distinguishing mark adopted by themselves. They are designed to represent respectively the Tories and the Whigs.

HIGHHOLE (variant of *highhoe, heighaw, haihow*, possibly onomatopoetic in origin: connected by popular etymology with *high* + *hole*). A local name in the United States for the flicker (q.v.), heard in many forms, and having many relatives in the provincial speech of both Great Britain and America. Consult *Bulletin Nuttall Ornithological Club* (Cambridge, 1881).

HIGHLAND, or **KYLOE, CATTLE.** A race of small hardy cattle, of the western 'Highlands' of Scotland, descended from ancient stock, and noted for their shaggy, usually reddish coats and hardy constitutions. They are comparatively short-horned, and feed in a semi-wild condition upon the hilly moors. See Plate of WILD CATTLE, under CATTLE.

HIGHLANDERS. Scottish regiments of the British Army, the oldest of which is the Black Watch (q.v.), founded in 1668. The Scottish social structure and conditions generally offered peculiar facilities for good recruiting — which fact, together with their proved military qualifications, encouraged the British Government in the organization of the following regiments:

ORIGINAL TITLE	Regimental number	Date of formation	Present territorial title	Number and headquarters depot of territorial district		Battalion numbers	
						1st	2d
Black Watch, The	42	1704	Royal Highlanders, The	42	Perth, N. B	42	73
71st Highlanders	71	1777	Highland Light Infantry	71	Hamilton, N. B	71	74
Ross-shire Buffs	72	1777	Seaforth Highlanders	72	Fort George	72	78
74th Highlanders	74	1787	2d Battalion Highland L. I	71	Hamilton, N. B	71	74
Duke of Albany's Own.	78	1793	2d Battalion Seaforth Highl'ders.	72	Fort George	72	78
Cameron Highlanders.	79	1805	The Queen's Own, Cameron H'ders	79	Inverness	79	79
Gordon Highlanders	92	1796	2d Battalion Gordon Highlanders	75	Aberdeen	75	92
Sutherland Highl'ders.	93	1800	2d Bat. Argyle and Sutherland H.	91	Stirling	91	93
Other Scottish regiments (not Highlanders) are:							
Cameronians	26	1688	Scottish Rifles	26	Hamilton, N. B	26	90
The Douglas Reg't	1st	1660	Royal Scots, Lothian Regt	1	Glencorse, N. B	1	1
Scots Fusilier Guards	21	1660	Scots Fusiliers	21	Ayr, N. B	21	21

The personnel of the Highland regiments is no longer confined to Scottish officers and men; the changed industrial conditions and widely diffused educational facilities having reduced recruiting in Scotland to a very low ebb, despite the efforts of the British Government. See *British Empire* under ARMIES.

HIGHLAND FLING. One of the distinctive national dances of Scotland. It is ordinarily danced by three or four persons to the music of the strathspey (q.v.). The time is $\frac{4}{4}$, and most of the music is distinguished by an extended use of syncopation. Its name is derived from the peculiar, flinging action of the steps as the performer dances alternately on each leg, throwing the other out in front and behind. Like all Scotch dances, the Highland fling is animated, sharp, and vigorous.

HIGHLAND MARY. A poem by Robert Burns (1792), celebrating his affection for Mary Campbell, a nursemaid in the family of Gavin Hamilton and daughter of a sailor settled near Dunoon. She died shortly after their betrothal.

HIGHLAND PARK. A city in Lake County, Ill., 22 miles north of Chicago; on Lake Michigan and on the Chicago and Northwestern Railroad (Map: Illinois, E 1). Picturesquely situated on wooded bluffs one hundred feet above the lake, it is a popular residential suburb of Chicago, and has the Northwestern Military Academy and other educational institutions. Fort Sheridan (q.v.) adjoins the city on the north. Population, in 1890, 2163; in 1900, 2806.

HIGHLANDS. A name applied to the mountainous region north of and including the Grampian Mountains in Scotland. This district has no political or civil boundary, and is separated by only a vague line of demarkation from the division called the Lowlands. It may be briefly described as that portion of the north and northwest of Scotland in which the Celtic language and manners have lingered until modern times. See GREAT BRITAIN; also Browne, *History of the Highlands and the Highland Clans* (4 vols., 1838).

HIGHLANDS OF THE HUDSON. A group of mountains extending in a southwest-northeast direction through Rockland, Orange, Putnam, and Dutchess counties, N. Y., and forming a northerly continuation of the Blue Ridge of Pennsylvania and New Jersey. The Hudson River crosses the mountains through a winding gorge whose sides rise abruptly in places to peaks about 1500 feet above the water. The region abounds in beautiful scenery, and has great historic interest. Stony Point and West Point, two promontories on the west side of the river, were the scenes of stirring struggles during the Revolution. See HUDSON RIVER; NEW YORK.

HIGH LIFE BELOW STAIRS. An amusing farce by James Townley (1759). The authorship was concealed for some time, and the comedy has been attributed to Garrick. It has been translated into French and German, and frequently produced. See LADY BAB.

HIGHNESS. See TITLES OF HONOR.

HIGH PLACE (Heb. *bāmāh*, height). An expression frequent in the Old Testament, and invariably used (except in poetry) as a designation of a sanctuary. All worship in ancient Israel was conducted at high places, and there was, therefore, a very large number of such shrines. Generally they were located on the top of a hill or a mountain, which accounts for the name; but sometimes a *bamah* was within a city, at the gate, or in a valley, not necessarily even on an artificial mound, as has been supposed. At such a high place there would be an altar, a sacred stone of phallic shape, a wooden post, a sacred tree, or often a sacred fountain. While some may have been only small shrines, others had large halls where the worshipers took part in the sacrificial meal, as well as an *adytum* for the image of the deity. There probably was an idol in every such temple. At Bethel and Dan there were bull images of Yahweh, at Jerusalem a brazen serpent as well as bulls. The worship at these sanctuaries was, in earlier times, characterized by joy, by eating, drinking, dancing, and sexual indulgences. This rejoicing was hallowed by offerings of sacrifices, libations, and intercourse with the hierodules. As most of these high places were taken over from the Canaanites and the denunciations of the prophets show the continuance in Israel, even at a late date, of the worship of the Baals, it is probable that with Yahweh other deities also, especially the *Baalim* or *Elim*, 'lords' or 'gods,' to whom the sanctuaries had once belonged, were recognized by sacrifices in these temples. That these high places were once regarded as altogether legitimate is evident from the fact that Samuel conducted worship at a number of them, David, Solomon, and all his successors down to Josiah sacrificed in them, and at these sanctuaries the stories of the patriarchs were told. Many of the stories of Genesis cluster about the high places of Shechem and Bethel, Mizpah and Mahanaim, Hebron and Beersheba, and Beer-la-hai-roi. But the prophets of the eighth century, men like Amos and Hosea, Isaiah and Micah, denounced these temples of the nation and the sacrificial cult there carried on. They maintained that Yahweh had not commanded that sacrifices be brought to Him, that Israel was happiest and most pleasing to Yahweh when no sacrifices could be offered, viz. in the wilderness; and they attacked the drunkenness and religious prostitution that flourished at these temples. While the earliest law of Israel, the Covenant Code (Ex. xxi.-xxiii.), regards worship at those sanctuaries where Yahweh had revealed Himself as perfectly legitimate, the Deuteronomic law introduced by King Josiah about 620 declares that sacrifices shall be offered in only one place. This centralization of the cult in Jerusalem may have been an ideal of the local priesthood as early as the days of Hezekiah, and some Judean temples may have been closed and destroyed as is stated in II. Kings xviii. 4, 22; xxi. 3, though it is probable that the author of these verses has wrongly given Hezekiah credit for the same reformatory work as Josiah. That Josiah attempted to carry out the change proposed in Deuteronomy, and did so with a high hand, there can be no doubt (II. Kings, xxiii.). But it is equally certain that the affection of the people could not by his violent measures be diverted from their ancient temples. The destruction of the temple in Jerusalem by Nebuchadnezzar naturally enhanced the importance of the smaller shrines and caused a reaction against the Yahweh cult in favor of the worship of other gods. The reluctance to rebuild the temple in Jerusalem complained of by Haggai was no doubt in part caused by this reaction. There is evidence in parts of the Book of Isaiah written during the Persian and Greek periods of the survival of licentious and idolatrous rites that can scarcely be connected with the temple in Jerusalem. A positive proof of the existence of other temples besides that in the capital at a very late time is found in the letter of Onias to Ptolemy and Cleopatra, quoted by Josephus (*Ant.* xiii. 3, 1), in which he states that the Jews of Egypt, Cœle-Syria, and Phœnicia have many temples of different patterns, and therefore wishes to have permission to build his temple in Leontopolis (see ONIAS'S TEMPLE), on the model of that in Jerusalem. From this it must be concluded that the idea of the illegitimacy of all worship except at Jerusalem cannot have been universally cherished among the Jews, and that the hill temples are likely to have attracted worshipers as late as in the second century B.C. If Onias's letter should prove to be a forgery, its testimony would not be of less value, as it would then show a still longer survival of this attitude. Consult Von Gall, *Altisraelitische Kultstätten* (Giessen, 1898), and Moore, in *Encyclopædia Biblica.*

HIGH PRIEST (Heb. *hakkohen haggadol*). The chief of the Jewish priesthood. There is no evidence that in the pre-exilic period there was any distinctive office of high priest. In early days among the Hebrews, the rulers united in their persons priestly and civil functions, and to a certain extent the Kings of Israel and Judah continued to perform offices of a priestly character. By the side of the king-priest there were guardians of the sanctuaries scattered throughout the country, and as some of those (e.g. at Shiloh, Bethel, Samaria, and Jerusalem) grew in importance an ecclesiastical government gradually developed, and naturally in such significant centres as Samaria and Jerusalem there was always one priest who was regarded as supreme over the others. In the Deuteronomic code there is no reference as yet to the high priest as such; nor does Ezekiel make mention of such an office in his sketch of the future theocracy. Deuteronomy makes no distinction between priests and Levites; in Ezekiel the priests are members of the Zadokite family, to whom is assured control of the temple at Jerusalem, while the Levites are the body-servants of the priests and represent those attached to the old sanctuaries of the country, which were set aside with the establishment of the principle of central authority for the temple of Jerusalem. (See DEUTERONOMY.) In the post-exilic priestly code (see EZRA; LEVITICUS), however, the prerogatives of the Zadokites are thrown aside, and in accord with the general theory underlying this code, which traces everything back to the days of Moses, the priesthood is fixed by Moses himself in the family of his brother Aaron. The latter is accorded the dignity of high priest and the office is handed down to Aaron's third son, Eleazar, and by the latter to his son, Phinehas, and so in regular succession. The regulations for the office are set forth in great detail in the Priestly Code (cf. Lev. viii., x., xxi., etc.), but it must be borne in mind that these regulations remained to a certain extent in the domain of theory. Many more restrictions were attached to the office than belonged to the ordinary office of a priest. The high priest was allowed to marry none but a virgin, and one of his own tribe; every impure contact, even of the dead bodies of his own parents, he was strictly forbidden. besides many other things that might cause defilement. His functions consisted principally in the general administration of the sanctuary and all that belonged to the sacred service. He alone was allowed to enter the Holy of Holies on the Day of Atonement, and to consult the urim and thummim (q.v.). His costume was of surpassing costliness and splendor, comprising numerous vestments in addition to those of the ordinary priests. This costume was laid aside by the high priest when, on the Day of Atonement, he went to perform the service in the Holy of Holies; a simple garb of white linen—the funeral dress of the Jews in later times—was all he wore on that occasion. The revenues of the high priest were in the main the same as those of the other priests; but, according to the Talmud, he was to be richer than these, and if his own means were insufficient, he was to be provided with means by his brethren, in virtue of his position; the other priests never addressed the high priest but by *ishi kohen gadol*, 'my lord high priest.' Before the law, however, the high priest was equal to any other Israelite. See PRIEST; LEVITE; AARON; LEVITICUS.

HIGH SCHOOLS. A term that has been variously employed in different countries at different times to indicate a type of schools. In Germany in official language it is customary to refer to the universities as high schools (*Hochschulen*). In the middle of the sixteenth century in Edinburgh the designation was applied to a famous educational institution of a liberal character, but in grade below the university. In the United States it is very generally used to indicate an important and definite type of schools which forms a component part of the public-school system. This term came into use between 1820 and 1850, when, in place of or by the side of schools called 'academies,' which were maintained by endowment or at private expense, schools of a corresponding grade were established at public expense. Such institutions were variously designated at first. In Philadelphia the Central High School yet retains its original name; in New York the corresponding institution was known first as the Free Academy, and later as the College of the City of New York. This institution has since expanded in scope until it offers approximately the ordinary college course. In Baltimore the corresponding institution is known as the City College, while similar institutions for girls bear the name of high schools. The Boston Latin School, founded in early colonial times, is a free public high school, fitting boys for college.

The term high school came into use in Boston when in 1821 the English High School was established as complementary to the Latin school. A few years later the girls' high school was founded. During the period of Horace Mann's secretaryship of the Massachusetts Board of Education (1837-48) a system of high schools was instituted. This example of Horace Mann was followed by other educational leaders, notably by Henry Barnard in Connecticut. From the middle of the nineteenth century the movement in the establishment of high schools became very general. In many of the Western States high schools have from the first formed a part of the public-school system, and in some instances their maintenance is recognized by the Constitution of the State. During the year 1899-1900 there were reported to the United States Commissioner of Education 6005 public high schools, having an attendance of 519,251 pupils. This was an increase in the year of more than 137 per cent. in the number of schools, and of more than 155 per cent. in the number of students attending. The courses of study, the terms of admission, and the length of time required for completing the instruction differ widely, but in general the term high school in this country means a school supported from the public treasury, where tuition is usually (but not necessarily) free, and where pupils of both sexes are carried forward from the grammar schools to the study of 'higher' branches, and thus fitted for active life or for admission to universities, colleges, and technical schools. In its origin the high school, as also the academy, arose in answer to the demands for schools of a lower grade than colleges, appealing to a wider constituency and satisfying more needs. For the most part the high school yet retains these characteristics. In the central and western Commonwealths of the Union it fits directly for colleges, and especially for the State university; but this is due to the fact that there is a very great freedom of choice in regard to the subjects essential for entrance to college and university courses. The adjustment has been made by the college rather than by the high school. By far the larger part of high-school graduates do not enter college. However, high schools seek to meet various needs either by offering a variety of courses or in large cities through distinct schools. Thus, there are the classical courses or schools, which are distinctively college-preparatory in their nature; the scientific or English courses or schools, which furnish preparation for professional schools or simply equipment in general; there are also of recent years manual training (q.v.) high schools or courses, giving a technical or industrial preparation, and commercial high schools, with a corresponding purpose in view. No part of the educational system of the United States is so responsive to local demands and to public opinion. Hence arises the greatest variety of local conditions in these schools in city and country. For the most part they are wholly under local control, and are subject to general State supervision of only a nominal character. In some States, such as New York, this supervision is more intimate; in others, such as California or Michigan, it is exercised chiefly through the State universities. This amenability to local influences constitutes the greatest element of their strength, while at the same time the absence of general standards constitutes a most serious element of weakness. That the public high school is the representative secondary school of the United States is indicated by the fact that during 1899-1900 private secondary schools numbered only 1632, with an attendance of 110,797 pupils, while the increase for the previous decade had been only 21 per cent. and 16 per cent. respectively.

Consult: Butler, *Education in the United States* (Albany, 1900); Brown, *History of Secondary Education in the United States* (New York, 1902); *Reports of the United States Commissioner of Education* (Washington). See ELECTIVE COURSES AND STUDIES; GRAMMAR SCHOOL; NATIONAL EDUCATION, SYSTEMS OF; SECONDARY SCHOOLS.

HIGH SEAS. As a term of admiralty law in England, the open, uninclosed waters of the ocean; that "part of the sea which lies not within the body of a country." It is used in contradistinction to bays, harbors, and arms of the sea inclosed within the *fauces terræ*, or narrow headlands or promontories. The high seas, or 'the main sea,' to use Sir Matthew Hale's synonym, are deemed within the exclusive jurisdiction of the Admiralty, up to high-water mark when the tide is full.

The term has been much considered by the judicial tribunals of the United States, and the Federal Supreme Court has held it applicable to the open, uninclosed waters of the Great Lakes. This conclusion, however, was not unanimous. According to the majority view, the Great Lakes possess every characteristic of seas. They are of large extent, wholly navigable by the largest vessels; they separate States in many instances, and in some instances constitute the boundary between independent nations; and their waters, after passing long distances, debouch into the ocean. We may as approximately designate the open, uninclosed waters of the lakes as the high seas of the lakes, as to designate similar waters of the ocean as the high seas of the ocean, or similar waters of the Mediterranean as the high seas of the Mediterranean. A minority of the court vigorously dissented, insisting that legal usage had limited the term to the ocean, the common highway of all nations.

While the high seas are, as a rule, the common highway of all nations and not the subject of ownership or monopoly by any one, a State is entitled to a large measure of jurisdiction over that part of them lying within a marine league of its coast. This control is accorded by international law, in order that a State may protect itself by proper fiscal and defensive regulations. Accordingly, within this three-mile limit, the vessel of a friendly power may be boarded and searched, on suspicion of being engaged in unlawful commerce, or of violating the revenue laws. It may even be chased beyond these territorial waters and arrested and searched outside their limits. See BERING SEA CONTROVERSY; FISHING LAWS; and MARE CLAUSUM. Consult the authorities cited under the above titles and under ADMIRALTY LAW; also *United States vs. Rodgers*, 150 United States Reports, 249 (1893).

HIGH STEWARD. See STEWARD.

HIGH TREASON. See TREASON.

HIGHWAY. A place over which the public generally has a right to pass. In Lord Holt's language, "it is the *genus* of all public ways." As a term of the common law, it includes roads, streets, foot-paths, bridle-paths (or ways along which the public is entitled to ride or lead a horse), driftways (or places along which the public may drive cattle), public canals, ferries, bridges with their approaches, public squares, and navigable streams. In statutes, however, it is sometimes used in a narrower sense, being limited to country roads.

Ordinarily, the right of the public in a highway is that of user, not of land-ownership. To this extent it partakes of the nature of an easement (q.v.), but it is not a true easement, because there is no dominant estate. The public enjoys a right of way, but not as the owner of an estate in land to which such a right is appurtenant. A private way, on the other hand, is an easement, for its user belongs to particular persons, by reason of their ownership of certain lands. Whether a place of passage is a highway or a private way does not depend upon its being a thoroughfare, that is open at both ends, or leading to a public place. It is now well settled that a *cul-de-sac* may be a highway. If the public is entitled to pass and repass, the place is a highway, although its terminus is at the gate of a private house.

Highways are created either by act of the Government, or by dedication of the landowner and acceptance by the public. Dedication may be either express or implied. It is of the first kind where a landowner formally lays out a public road or street and gives notice that the public may use it. The dedication is implied where the public makes use of a way without objection of the landowner. and under circumstances indicating his assent to the public use. One may irrevocably convert a portion of his land into a highway, by selling lots bounded along a specified road or street, without securing an acceptance of the highway by the proper authorities. In such a case, he is bound to keep the road or street open for the benefit of those who have been induced by his representations to become purchasers of abutting property, but the public is not bound to keep the way in repair. In order that this burden be cast upon the public, there must be an acceptance by the proper authorities. At common law, a formal act of acceptance is not required. Any assumption of control, which is properly exercisable by the proper authorities in the case of highways, such as letting a contract for the improvement of the road or street in question, will establish an implied acceptance. In the United States country highways are created more frequently by the act of Government than by private dedication. At times they are established by special legislation, but as a rule under general statutes. These differ in the various States, although their principal provisions are much alike. They ordinarily require a formal application for the highway, proper notice to the various persons whose property will be directly affected, a proper hearing before certain officers or tribunals, a proper assessment of damages or of benefits, and a proper record of the proceedings. After a highway has been established, it can be lawfully altered or vacated only by act of Government. This may be accomplished by special legislation. As a rule, however, the State delegates its authority over this subject to county, town, or city officials. In this country, even the State cannot change or vacate a highway without making compensation to landowners, whose property rights are taken away thereby. This is because of constitutional prohibitions against the taking of private property for public use without just compensation. In England, Parliament is not thus hampered by constitutional limitations.

The ordinary rule, both in England and in this country, is that the public has only a user of the surface of the highway; the fee of the land remains in the adjoining owner. Under the first branch of the rule, the public is entitled to use every part of the highway, and is not limited to the traveled or beaten part only. Accordingly, if any portion of a highway is unlawfully occupied by a fence, gate, wall, or building, such obstruction is a nuisance, and may be abated either by the public authorities, or by any traveler whose right to use the road is interfered with. This is one of the few cases where a person is allowed to take the law into his own hands. It is his duty, in such cases, to proceed in a peaceable manner, and to do no more injury than necessary to the property which constitutes the nuisance. The person who is responsible for the nuisance is liable in damages to any one injured thereby. In some circumstances a traveler has a right to deviate from the highway and go upon adjoining lands. This is based upon the ground of public convenience and necessity. Highways being established for the use and benefit of the whole community, a due regard for the welfare of all requires that when temporarily obstructed by storm or flood, travel should not be interrupted. A person traveling on a highway is in the exercise of a public right, and if he is compelled by impassable obstructions to leave the thoroughfare and go upon private lands, he is still in the exercise of the same right. But this right of deviation rests upon necessity, not upon the personal convenience of the traveler. It is properly exercisable, therefore, only when the obstructions are due to sudden or recent causes, or when the traveler cannot make his journey by other ways.

Under the second branch of the rule, stated above, if the land on both sides of a highway belongs to the same owner, then the right to the ground beneath the road belongs to him also; and if the land on one side belongs to a different owner from the land on the other side, then each is presumed to have the right to the ground under the highway up to the middle line. This rule is more than a mere theory, for though neither of the adjoining owners can ever interfere with the passage of the public, who have an absolute right forever to use it for every lawful purpose of transit, yet the adjoining owner has all the rights incidental to the property which do not interfere with this public right of passage. Thus, if a mine were discovered under the road, the adjoining owner would have the sole right to dig it and keep the contents; all that he would require to attend to would be to leave sufficient support for the surface of the road. So, in like manner, where there are strips of land at the side of the road on which trees grow or grass, these belong solely to the adjoining owner, and the public have no right to them. Another consequence follows, that if, for example, a gas company or a water company without due permission were to presume to take up the highway in order to lay pipes under the surface, this would be not only an indictable nuisance as regards the public, inasmuch as it obstructs the use of the road for the time being, but would subject the company to an action of trespass at the suit of the adjacent owner, whose property consists of all that lies under the surface of the highway. Still another consequence of the same rule is, that if a person is loitering on a highway, not with the intention of using it as a traveler, but for some unlawful purpose, such as creating a disturbance and abusing an adjoining property-owner, he may be dealt with as a trespasser.

The English common law imposed the duty of maintaining and repairing all highways upon the parish. If the duty was neglected the parish was indictable, and was liable for damages sustained by travelers through its negligence. Public bridges, although included in the term highways, as we have seen, were an exception to the rule just stated. The duty of constructing and maintaining them rested upon the county as a part of the *trinoda necessitas*, or threefold service, to which all grants of absolute ownership of land were formerly subject. At present, the maintenance and general control of highways and bridges in England and Wales are committed chiefly to district and county councils, in accordance with the Local Government Act, 1894 (56 and 57 Vict., c. 73).

In this country, while every highway is subject to the control of the State or Federal Government, comparatively few roads are constructed and maintained directly either by a State or the nation. The power to establish them and the duty of keeping them in repair are generally delegated to some subdivision of the State, such as the township, the county, or the city. The liability of these political subdivisions for their negligent performance of this duty varies in the different States. As a rule, however, they must respond in damages for injuries caused to travelers by defects in highways of which the proper authorities had notice, and which it was their duty to remedy. In some States, a township is divided into road districts, and all ordinary repairs are made by the inhabitants of these several divisions, while extraordinary repairs, as well as the maintenance of bridges, belong to the township at large. In other States, the unit of highway administration is the county or city.

The Legislature has power to commit the work of improving and repairing highways to private corporations. Accordingly, turnpike and similar companies receive from the State authority to construct roads and keep them in good repair, and to reimburse themselves by tolls levied upon the members of the public using the roads. By this system, the cost of maintaining proper roads is shifted from the property-owners of a particular territory to the traveling public; but the cost is still borne as a tax, which the State has a right to impose. It is also established that the Legislature of a State may lawfully authorize temporary obstructions in highways, and may delegate the exercise of this power to municipal corporations. Hence come city ordinances providing for permits to deposit building materials in city streets, to erect stands, to use apparatus for hoisting goods, and the like. Gas and water companies receive authority to excavate highways and lay pipes; telegraph and telephone companies are permitted to erect poles and string wires along public thoroughfares, and even railroad companies are allowed to lay tracks and run cars over their surface. If the use which such companies are authorized to make of the street subjects adjoining property to injuries not contemplated or provided for when the street was laid out, it may give the property-owners the right to compensation for these injuries from the users. The use of city and village streets for gas and water mains is generally deemed to be within the scope of the original dedication, but not so in the case of country highways. Railroads, on the other hand, are usually regarded as an encroachment on the rights of the owner of the fee of a road, whether urban or rural, though the contrary has usually been held in the case of street railways.

In England, teams meeting upon a highway turn to the left. In this country, they turn to the right. This usage of the road has received legislative sanction in some of our States, and penalties are imposed upon its violators. Consult: Woolrych, *The Law of Ways* (2d ed., London, 1847); Elliott, *The Law of Roads and Streets* (Indianapolis, 1900); Birdseye, *General Statutes of New York—Highway Law* (New York, 1901).

HIKONE, hē'kô-nȧ. A town in the Japanese Prefecture of Shigo, situated in the central part of Nippon, on the eastern shore of Lake Biwa (Map: Japan, E 6). Its chief attraction is the remains of a fine feudal castle, the former seat of a famous Daimio. Population, about 19,000.

HILALI, hė-lä'lė, Badr ud-Din. A Persian Sufi poet of the first third of the sixteenth century, born in Astrabad and educated at Herat. In 1531 he was imprisoned and killed by Obeid

Khan, as a Shiite heretic, although it seems certain that he had long before forsaken the national heresy and become an orthodox Sunnite. His poems include the epics, *Sifat Alasyikin* ("On the Ways of Lovers"), and, most famous of all, *Shāh u Gada* ("King and Dervish"), translated by Ethé in *Morgenländische Studien* (1870), and the lyric *Divan*, published at Cawnpore in 1864.

HILA'RIA (Lat. nom. pl. of *hilaris*, Gk. *ἱλαρός*, *hilaros*, gay). A Roman festival, celebrated in honor of Cybele at the vernal equinox. It began on March 22d and closed on the 25th. The last day of the feast was the most important, and on it the inhabitants of the city abandoned themselves to the most extravagant merry-making. The only religious ceremony in connection with it was the solemn procession of the priests who bore round the streets the statue of the mother of the gods. The festival celebrated the departure of winter, and hailed the approach of spring.

HILA'RION, Saint (c.288-371). The reputed founder of monachism in Palestine. According to the legendary and untrustworthy account of his life, he was born at Tabatha, near Gaza, in 288, was converted at Alexandria, and, attracted by the fame of Saint Anthony, went to visit the latter in his hermitage and became his disciple. Returning to Palestine with some companions, while still only a lad of fifteen, he gave away all the property which he had inherited by the recent death of his parents, and withdrew into the desert between the sea and the marshes on the Egyptian border. He observed the most rigid asceticism, and after twenty years of this life was rewarded with rapidly growing fame, miraculous gifts being attributed to him; disciples and imitators multiplied to the number of two or three thousand, all under the spiritual control of Hilarion. When sixty-three years old, the death of Saint Anthony being revealed to him, he went to Egypt and visited the scene of that saint's labors; afterwards he proceeded with a favorite disciple, Hesychius, to Sicily, where his popularity rendered the quiet and retirement which were congenial to him impossible. A further migration to Epidaurus thus became necessary, and ultimately he found a resting-place in Cyprus, the diocese of his friend Epiphanius, where in a lonely cell among some almost inaccessible rocks he died in 371. He is commemorated by the Roman Church on October 21st. Consult Israel, "Die Vita Hilarionis des Hieronymus," in *Zeitschrift für wissenschaftliche Theologie* (Jena, 1880).

HIL'ARY (Lat. *Hilarius*). Pope, A.D. 461-68. He was an earnest promoter of the faith, and severe in discipline. During his pontificate canons were adopted forbidding the ordination of men who had married a second time, or those who had married widows, and also forbidding bishops to nominate their successors. He is a saint in the Roman calendar, and his day is September 10th.

HILARY, Saint, Bishop of Arles (401-49). A churchman whose name occupies a conspicuous place in the history of the fifth century. He was born at Arles, and was made bishop there in 426. As metropolitan bishop he became involved in a serious controversy with the Pope, Leo the Great. The cases of two deposed bishops having been carried to Rome on appeal, the condemnation was reversed; but Hilary refused to submit to the decision, maintaining that the authority was uncanonically exercised. In the end, however, he sought a reconciliation with the Pope, and the dispute was amicably terminated. Hilary died at Arles in 449. His works are in Migne, *Patrol. Lat.*, i. His day is May 5th.

HILARY, Saint, Bishop of Poitiers (c.320-66). One of the Latin Church-fathers. He was born of pagan parents at Poitiers about 320. His conversion to Christianity was mainly the result of his own study. About the year 353 he was elected bishop of his native city, and immediately rose to the first place in the Arian controversy. Having provoked the displeasure of the Court party, he was imprisoned and sent into exile in Phrygia (356); but appears in the Council of Seleucia in 359, and was permitted to resume possession of his see, where he died in 366. The Church holds his day on January 13th. Hilary's theological writings are especially valuable for the history of the Arian party, and particularly for the doctrinal variations of that sect, and the successive phases through which it passed between the Council of Nicæa and the first Council of Constantinople. The best edition is that of the Benedictine Dom. Constant (Paris, 1693), or the reprint of it with additional matter by Maffei (Verona, 1730; in Migne, *Patrol. Lat.*, ix. and x.). His selected works, with biographical and critical introductions, have been translated in the *Nicene and Post-Nicene Fathers*, 2d series, vol. ix. (New York, 1890). His determined opposition to Arianism won him the epithet 'Athanasius of the West.' For his life, consult Cazenove (London, 1883) and Largent (Paris, 1902).

HILARY TERM. In English law, one of the four terms held for the administration of justice by the courts of common law, and named from the saints' days nearest to the date of beginning the terms. Hilary term was formerly appointed to commence on January 11th and to end on January 31st. It is now, by statute, a movable term, ending on the Wednesday before Easter. See Term (of Court).

HIL'DA. A New England girl who goes to Rome to pursue the profession of painting, in Hawthorne's *Marble Faun*. A watch-tower which contains an image of the Virgin, and in which the original of this character is supposed to have kept a light continuously burning, is still pointed out, in Rome, as Hilda's Tower.

HILDA, or **HILD,** Saint (614-80). Abbess of Streanshalch or Whitby. She was a member of the royal family of Northumbria, and was baptized by Paulinus (q.v.), with her kinsman, King Edwin, April 11, 627. During the pagan reaction which followed Edwin's defeat and death Hilda was tempted to settle with her widowed sister Hereswid at the Monastery of Chelles, 10 miles from Paris; but she was recalled to England by Bishop Aidan (q.v.), and in 649, two years after her consecration as a nun, she was appointed to succeed Heiu, the abbess of Heortea, or Hartlepool. When, in fulfillment of the vow which he had made before the decisive battle with Penda (November 15, 655), Oswy dedicated his infant daughter to God, it was to the care of Hilda that he intrusted her. In 657 the abbess founded the famous monastery on the cliffs of Streanshalch or Whitby, and for the next twenty-two years she ruled over her double community of monks and nuns, among whom were Saint John of Beverley and the poet Cædmon. Hilda died November 17, 680. Her day in the Roman calendar is November 17th.

HIL′DEBERT OF TOURS, tōōr (c.1055-c.1133). A French prelate and author, born at Lavardin, near Vendôme. Tradition says he was the pupil of Berengarius of Tours, but this is not established. In 1092 he was made archdeacon, and in 1097 Bishop of Le Mans. After some difficulties with the Count of Le Mans, the Bishop found a new enemy in William Rufus, who took the city about 1099. He had constant quarrels with the neighboring prelates, and finally was in almost open rebellion against the King, Louis the Fat. In 1125, somewhat against his will, he was elected Bishop of Tours. Two years afterwards he presided at the Synod of Nantes. Toward the end of his life he was on more amiable terms with the King. The works of Hildebert were edited by Antoine Beaugendre (1708), but far from perfectly, and in part by Baluze and Muratori. They consist of sermons, letters, theological writings, and poems. A collection of the latter was published under the title *Mélanges poétiques d'Hilibert de Lavardin* (1882). The treatise *Tractatus Theologicus*, formerly attributed to Hildebert, is by Hugues of Saint Victor.

HIL′DEBRAND. See Gregory.

HILDEBRAND, hĭl′de-bränt. The pseudonym of the Dutch poet Nikolaas Beets (q.v.).

HILDEBRAND. An aged warrior and sage in German legend, the tutor of Dietrich von Bern. He appears in the *Hildebrandslied*, and plays a leading part in the *Nibelungenlied* and other legends.

HILDEBRAND, Bruno (1812-78). A German economist and statistician, born at Naumburg-an-der-Saale, and educated at Leipzig and at Breslau, where in 1839 he became professor. In 1841 he was appointed to a professorship at Marburg, from which he was suspended in 1846, because of the tone of a contribution to a London paper. He was elected to the National Assembly at Frankfort from Marburg in 1849, after having been reinstated in his academic position. He went to Zurich as professor in 1851, and five years later to Bern as the head of the new Swiss Bureau of Statistics. But, as a result of differences with his superiors, he was dismissed, and in 1861 became professor in the University of Jena and director of the Bureau of Statistics. His works comprise: *Nationalökonomie der Gegenwart und Zukunft* (1848); *Die Kurhessische Finanzverwaltung* (1850); *Statistische Mitteilungen über die volkswirtschaftlichen Zustände Kurhessens* (1853); and *Beiträge zur Statistik des Kantons Bern* (1860). He edited *Jahrbücher für Nationalökonomie und Statistik* (1863 et seq.).

HILDEBRAND, Hans Olof (1842—). A Swedish historian and antiquarian; son of the archæologist and numismatist Bror Emil Hildebrand (1806-84). He was born at Stockholm; studied at Upsala; in 1865 was made amanuensis of the archæological museum; and in 1879 succeeded to his father's position of State antiquarian. His special study was Norse archæology and the related subjects, and his works are: *Svenska folket under hednatiden* (last edition, 1872); *De förhistoriska folken i Europa* (1873-80); *Fynder i Troas och Homers Troja* (1878); *Lifvet på Island under sagotiden* (last edition, 1883); *Sveriges medeltid* (1879-97), a history of civilization; the second volume of *Sveriges Historia*, dealing with the mediæval period; *Från äldre tider* (1882); *The Industrial Art of Scandinavia in the Pagan Time* (1882); *Zur Geschichte des Dreiperiodensystems* (1886); *Wisby och dess minnesmärker* (1892-93); *The Industrial Art of Scandinavia in the Middle Ages* (1893); and *Sveriges mynt under medeltiden* (1895). In 1872 he founded the *Kunglig Vitterhets Historie-och Antiquitets akademiens Månadsblad*, and in 1880 became editor of *Antiqvarisk Tidskrift för Sverige.*

HILDEBRAND, Rudolf (1824-94). A Germanic philologist. He was born in Leipzig, and studied there. From 1848 to 1868 he taught in the Thomasschule. In 1864 he began to act as one of the editors of Grimm's *Deutsches Wörterbuch*, and five years later became professor of modern German literature and language in the University of Leipzig. His most important works are: *Vom deutschen Sprachenunterricht in der Schule und von deutscher Erziehung und Bildung überhaupt* (7th ed. 1901); and *Gesammelte Aufsätze und Vorträge zur deutschen Philologie und zum deutschen Unterricht* (1890). Consult Burdach, *Zum Gedächtnis Rudolf Hildebrands* (Hamburg, 1896).

HILDEBRANDSLIED, hĭl′de-bränts-lēt. A fragmentary Old High German poem, the oldest preserved specimen of German heroic poetry. It is written in alliterative verse, and dates from the eighth century. It is known only through a manuscript preserved in the museum at Kassel, and written by two monks of Fulda at the beginning of the ninth century on two blank pages of a religious work. It narrates the combat of Hildebrand and his son, Hadubrand, who after many years of separation meet, and unknown to each other engage in a duel. The account breaks off without completing the story of the combat. The facsimiles of the manuscript have been published by W. Grimm (1830) and E. Sievers (1872), and a number of annotated editions of the text have appeared.

HILDEBRANDT, hĭl′de-bränt, Eduard (1818-68). A German landscape and marine painter. He was born at Danzig, September 9, 1818, the son of a house-painter. He traveled extensively, and was celebrated for his paintings of striking points of view, such as would interest the traveling public. As a lad he wished to be a sailor, but his father apprenticed him to the painter Meyerheim. He studied under Krause in Berlin, and under Isabey in Paris, in 1841. In 1843 he gained a gold medal in that city, and was invited by Humboldt to visit Brazil. The water-colors and oil paintings he made while there are now in the possession of the German Emperor. Hildebrandt visited the Canary Islands, Spain, and Portugal, and brought from those places two hundred water-colors of various subjects, also in the Emperor's possession. In 1851, by order of the King of Prussia, he went to Italy, Malta, Egypt, Palestine, Turkey, and Greece, and later traveled through Switzerland. In 1855 he was made professor and member of the Berlin Academy, and in 1856 he joined an Arctic expedition, as the result of which, at

Brussels in 1858, he obtained the gold medal for his "North Cape," painted while on that expedition. At Amsterdam he was given another gold medal for his "Sea of Marmora." Between 1862 and 1864 he traveled around the world, and brought home four hundred water-colors, which were exhibited in London in 1866. Among his works are: "Brazilian Primeval Forest," "Cave at Staffa" (1865), "Castle Kronborg" (1857), in the National Gallery, Berlin; "Moonrise in Madeira," Corcoran Gallery, Washington; "The Bay of Naples," Metropolitan Museum, New York; "By the Dead Sea," "Benares at Early Dawn," "Evening in Siam," and many others. His last work, "Under the Equator," a study of the ocean, popularly called "Das blaue Wunder" (the blue wonder), was the occasion of much argument and imitation. His paintings are not without technical merit, especially in color, but the painter of 'striking views' is never the great artist. His aquarelles excel his oil paintings. He died in Berlin, October 25, 1868. Consult: his *Reise um die Erde* (Voyage Around the World), edited by Ernst Kossak (Berlin, 1857); Arndt, *Eduard Hildebrandt, der Maler des Kosmos* (ib., 1869); Bruno Meyer, *Studien und Kritiken* (Stuttgart, 1877).

HILDEBRANDT, THEODOR (1804-74). A German painter, born at Stettin. He studied at the Berlin Academy, and afterwards became a pupil of Schadow. With this master he went to the Netherlands and traveled in Italy. Ultimately he was made professor at the Düsseldorf Academy (1836). His works are largely historical; many of them illustrate scenes from Shakespeare or Goethe; and he is also a portrait painter. His masterpiece is the "Murder of the Children of Edward IV." (1836), which is in the Spiegel Gallery at Halberstadt.

HIL'DEBURN, CHARLES SWIFT RICHE (1855-1901). An American bibliographer and librarian. He received his education in the private schools of his native city, Philadelphia, and in 1876 became librarian at its Athenæum. His literary work includes the compilation, *A Century of Printing: The Issues of the Press in Pennsylvania, 1685-1784* (2 vols., 1885-86), and the editorship of the *Statutes at Large* of Pennsylvania.

HIL'DEGARD, SAINT (c.1098-1179). A German nun, a friend of Bernard of Clairvaux, born at Böckelheim. She founded an abbey near Bingen; boldly attacked ecclesiastical abuses; and composed many mystical works, of which the best known is the *Scivias* (edited in Migne, *Patrologia Latina*, vol. cxcvii.). Consult the biography by Schneegans (Barmen, 1891); and Roth, *Die Lieder und die unbekannte Sprache der heiligen Hildegard* (Wiesbaden, 1880).

HIL'DEN. A town of the Prussian Rhine Province, situated nine miles east-southeast of Düsseldorf (Map: Prussia, B 3). It is a growing place, with manufactures of silk goods, carpets, machinery, etc. Population, in 1890, 8600; in 1900, 11,296.

HILDESHEIM, hĭl'dĕs-hīm. The former capital of the Bishopric of Hildesheim, in the Prussian Province of Hanover, situated on the Innerste, 21 miles south-southeast of Hanover (Map: Prussia, C 2). It has narrow streets, old monuments, some quaint, mediæval, highly ornamented façades, is partly surrounded by lofty walls, and contains many excellent examples of architecture owing to its having been a German home of the Romanesque and Renaissance art, including particularly the timber framework features. The Catholic cathedral, erected in the eleventh century and greatly modified, is built partly in the Romanesque and partly in the late Gothic. Its ancient cloisters are exceptionally curious and interesting. Its treasury is rich in objects associated with the lives of Charlemagne, Bishop Bernwald, and others. The brass doors and bronze Easter column are richly ornamented with reliefs; there are also a number of gilded sarcophagi, including that of Bishop Godehard. Against the wall of the cathedral stands a rose-bush which is 25 feet high and reputed to be a thousand years old. Two of the best examples of Romanesque architecture in Germany are the Catholic Church of Saint Godehard, erected in the twelfth century and recently restored—a basilica-shaped edifice surmounted by three towers—and the large Protestant Church of Saint Michael, founded by Bishop Bernwald at the beginning of the eleventh century, and containing his tomb. Saint Michael has an interesting interior, with good mediæval ceiling paintings.

Hildesheim contains also a number of interesting secular buildings, notably the fifteenth-century late-Gothic Rathaus, adorned with rare frescoes by Prell, and possessing valuable archives; and the former butchers' guild-house, regarded as perhaps the finest wooden building in Germany. There is an interesting mediæval public square—Altstädter Markt. The environs are pleasant, and not without interest. In recent times Hildesheim has been brought into special prominence by the collection of elaborate Roman silver plate (known as the Hildesheimer Silberschatz) discovered near the town in 1868. The collection consists of a complete service for three persons (69 pieces), and is believed to belong to the Augustan age. It is in the Berlin Museum. The educational institutions of Hildesheim include a Catholic Gymnasium, originally founded as a cathedral school in the ninth century, a Protestant Gymnasium, dating from the Middle Ages, a seminary for teachers, a theological seminary, an agricultural school, etc. There are also two museums of art and antiquities, including the valuable Römer Museum, and a municipal library of about 30,000 volumes. Hildesheim manufactures iron products, tobacco, sugar, cotton and woolen goods, machinery, church bells, carpets, preserves, wagons, glass, stoves, etc. The chief articles of commerce are grain, wool, leather, and building materials. Population, in 1890, 33,481; in 1900, 42,973, including 14,300 Catholics.

The town existed before the ninth century. It came into great prominence after it was made in 818 the seat of the Bishopric of Hildesheim. Under Bishop Bernwald (993-1022) Hildesheim became famous for its fine ecclesiastical buildings and religious art productions executed under the supervision of the Bishop. In the thirteenth century the town joined the Hanseatic League and acquired considerable privileges. After continuous struggles with its bishops Hildesheim came, upon the secularization of the bishopric, into the hands of Prussia in 1803, was annexed to Westphalia in 1807, and to Hanover in 1813, and with Hanover passed to Prussia in 1866. Consult: Wachsmuth, *Geschichte von Hochstift und Stadt Hildesheim* (Hildesheim, 1863); Bauer, *Geschichte von Hildesheim* (ib., 1891); Holzer, *Der Hildesheimer antike Silberfund* (ib., 1870); Lachner, *Die Holzarchitektur Hildesheims* (ib., 1882).

HIL'DRETH, Richard (1807-65). An American historian, born at Deerfield, Mass. He graduated at Harvard College in 1826, studied law, and began to practice in Boston in 1830. In 1832, however, he abandoned his profession to become editor of the Boston *Atlas*. In the autumn of 1834, being out of health, he went to the South, where he resided nearly two years on a slave plantation in Florida, and used his opportunity to study the workings of slavery. The result was a powerful anti-slavery novel, published in 1837 under the title of *The Slave, or a Memoir of Archy Moore.* It was reprinted in England, and in 1852 was republished in America under the title of *The White Slave.* When the annexation of Texas began to attract attention, he published in the Boston *Atlas* a series of articles which did much to intensify the hostility of the Northern people to that scheme. After publishing a *History of Banks* (1837) he passed the winter of 1837-38 in Washington as correspondent of the *Atlas*, and, upon his return to his editorial chair, entered warmly into the campaign for the election to the Presidency of General Harrison, a life of whom he published in 1839. A year later (1840) he translated Dumont's version of Bentham's *Theory of Legislation.* The same year appeared his *Despotism in America,* a work on the political, economical, and social aspects of slavery. A second edition with an added chapter was issued in 1854. From 1840 to 1843 he resided in Demerara, British Guiana, busying himself in editing two free-labor newspapers. After his return he published a *Theory of Morals* (1844) and a *Theory of Politics* (1853). The work, however, for which he is most remembered is his *History of the United States*, in six volumes (1849-56), in which he attempts to present the founders of the Republic in their true character, without trying to heighten their virtues or disguise their mistakes and faults. The first three volumes treat the period from 1492 to 1789; the second three from 1789 to the close of Monroe's first term (1821). The bias is Federalist, the treatment accurate and vigorous; but the graces of style are lacking, and the work is more consulted than read. In 1855 Hildreth published *Japan as It Was and Is*, and in 1856 *Atrocious Judges*, based on Campbell's *Lives.* For several years, ending with the inauguration of Lincoln as President, he was engaged on the staff of the New York *Tribune.* He went abroad in the summer of 1861 as United States consul at Triest, and died in Florence.

HILES, Henry (1826—). An English musician, born at Shrewsbury. He studied music with his brother John, a well-known organist, and, after holding various positions as organist, became in 1876 lecturer on harmony and counterpoint at Owens College, Manchester, and three years later at Victoria University. In 1867 he had received the degree of Doctor of Music. He was co-founder of the National Society of Professional Musicians (1882); for a time professor of harmony and counterpoint at the Royal Manchester College of Music; and in 1885 became editor of the *Quarterly Musical Review.* His compositions, which are popular in England, include the oratorios *David* (1860), *The Patriarchs* (1872), cantatas, anthems, psalms, songs, odes, and music for the organ and piano. His best-known treatises are: *Harmony of Sounds* (3 editions, 1871, 1872, 1878); *Part Writing, or Modern Counterpoint* (1884); and *Harmony versus Counterpoint* (1894).

HILFERDING, hĭl'fĕr-dĭng, Alexander Fedorovitch (1831-72). A Russian author, born at Moscow, of German stock. He studied in the city of his birth, and after travels abroad devoted himself to historical and ethnographic studies. An ardent Panslavist, he wrote: *On the Servians and Bulgarians* (translated into German by Schmaler, 1856-67); a history of the Baltic Slavs (1855); a history of their struggle with Germany in the Middle Ages (1861); and the very unscientific discussions of the relation of the Slavic languages to Sanskrit (1853), and to the allied languages (1853). His greatest work is the collection of popular songs, in the search for which he lost his life. The collection was edited by Hiltebrant (Saint Petersburg, 1873). Hilferding's complete works were published 1868-74.

HIL'GARD, Eugene Woldemar (1833—). A German-American agricultural chemist and geologist, born at Zweibrücken, Rhenish Bavaria. He studied at Zurich and elsewhere, came to America in 1835, but subsequently returned to complete his studies, receiving the degree of Ph.D. at Heidelberg, in 1853. In 1858 he was appointed State Geologist of Mississippi, and at the close of the Civil War resigned to become professor of chemistry at the University of Mississippi. From 1868 to 1875 he was professor of geology and natural history in the University of Michigan, and in 1875 was made professor of agricultural chemistry and director of the agricultural experiment station at the University of California. In 1894 he received the Liebig medal for distinguished services to agriculture, from the Munich Academy of Sciences. As a member of the Northern Transcontinental Survey, he devoted three years (1880-83) to a study of the agricultural capabilities of Oregon, Washington, and Montana. His investigations on the chemistry and physics of soil, and the reclamation of alkali lands, resulted in important contributions to agricultural science. Much of his work may be found recorded in the publications of the California Agricultural Experiment Station.

HILGARD, Julius Erasmus (1825-91). A German-American engineer. He was born in Zweibrücken, Rhenish Bavaria, went to Illinois in 1835; studied engineering, and was employed in the coast survey service. In 1862 he had chief charge of the office, and supervision under the Treasury Department of weights and measures. He was one of the members of the Metric Commission at Paris in 1872, and was made a member of the permanent committee. In 1875 he was president of the American Association for the Advancement of Science, and from 1881 to 1885 superintendent of the United States Coast Survey.

HILGARD, Theodore Charles (1828-75). An American physician and scientist, born in Zweibrücken, Germany. He came to America in 1835, and began his professional work in Saint Louis.

He gave especial attention to microscopic studies of lower organic life until his health failed, when he came to New York and engaged in the study of terrestrial physics with his brother Julius. His published works, besides papers appearing in the annals of various scientific societies, include: *Experimental Observations on Taste and Smell* (1854); *Exposition of Natural Series in the Vegetable Kingdom* (1858); *Phyllotaxis: Its Numeric and Divergential Law* (1859).

HILGENFELD, hĭl′gen-fĕlt, ADOLF (1823—). An eminent German Protestant theologian, of the Tübingen school, born at Stappenbeck, and educated at Berlin and Halle. In 1847 he became privat-docent, and three years later professor, at Jena. Editor of the *Zeitschrift für wissenschaftliche Theologie* (1858 sqq.), he wrote: *Die Clementinischen Rekognitionen und Homilien* (1848); *Das Evangelium und die Briefe Johannis nach ihren Lehrbegriff* (1849); *Ueber die Evangelien Justins,* etc. (1850); *Das Markusevangelium* (1850); *Der Galaterbrief* (1852); *Das Urchristentum* (1855); *Die jüdische Apokalyptik* (1857); *Der Kanon und die Kritik des Neuen Testaments* (1863); *Novum Testamentum extra Canonem Receptum* (2d ed. 1876-84); *Historisch-Kritische Einleitung in das Neue Testament* (1875); *Ketzergeschichte des Urchristentums* (1884); *Judentum und Judenchristentum* (1886); an edition of Hermas's *Pastor* (1887); and *Acta Apostolorum Græce et Latine Secundum Antiquissimos Testes* (1899).

HILIGUAYNA, ē-lē-gwī′nȧ, HILIGUEYNA, or HILIGVOYNA. A Visayan dialect in Panay Island, Philippine Islands (q.v.).

HILL, AARON (1685-c.1750). An eccentric English author, born in London. He treated in his verse many themes, from the creation of the world to doomsday. *Elfrid* (1710) is the earliest of eight dramatic pieces, either original or adapted. In conjunction with William Bond he edited an imitation of the *Spectator*, called the *Plain Dealer* (1724). His poems and letters were collected in 1753, and his plays in 1760.

HILL, ABIGAIL. Favorite of Queen Anne of England. See MASHAM, ABIGAIL.

HILL, AMBROSE POWELL (1825-65). An American soldier, prominent on the Confederate side in the Civil War. He was born in Culpeper County, Va.; graduated at West Point in 1847, and served in the United States artillery in the Mexican War; in Florida, against the Seminoles; and on the Coast Survey, but resigned in March, 1861, to accept a commission as colonel in the Confederate service. At the battle of Beaver Dam Creek, June, 1862, his troops took part in the attack on the Federal position, and on the retreat of the latter to Gaines's Mill and New Cold Harbor pursued and again attacked them, only to be again repulsed. At Antietam, September 17, 1862, he arrived just in time to stay the Federals, who were sweeping all before them, and so afforded Lee an opportunity to draw off his exhausted army. He commanded a division under Jackson at Fredericksburg, December 13, 1862. At Chancellorsville, May 2-4, 1863, he commanded the reserve; and it was his troops who, on being moved to the front to take the place of the decimated regiments that had borne the brunt of the first day's fighting, mistook Jackson's escort for Federals, and fired the fatal volley which caused Jackson's death. On May 10, 1863, General Lee reorganized his army, making three corps instead of two, and gave one corps to Hill, who at the same time was made a lieutenant-general. This corps he led in the battle of Gettysburg, and from the Wilderness until he met his death while reconnoitring at Petersburg, April 2, 1865.

HILL, BENJAMIN HARVEY (1823-82). An American legislator. He was born in Georgia; graduated at the State University in 1844, and within a year began the practice of law. In 1851 he was elected to the State Legislature as a Whig. He was a Unionist member of the State Secession Congress in 1861, but after striving vainly to prevent his State from seceding supported the movement. He was a member of the Provisional Confederate Congress the same year, and was soon afterwards chosen to the Confederate Senate. In 1865 he was for a short time a prisoner of war in New York. After the war he was an earnest Democrat, and denounced the reconstruction acts of Congress, his *Notes on the Situation* (1867-68) attracting wide attention. He supported Horace Greeley for the Presidency in 1872, and was defeated for the United States Senate in the following year. He became a member of the House of Representatives in 1875, and in 1876 was elected to the United States Senate, in which body he served until his death. A statue of him was erected in Atlanta in 1886. Consult Benjamin H. Hill, Jr. (editor), *The Life, Speeches, and Writings of Benjamin Harvey Hill* (Atlanta, 1891).

HILL, DANIEL HARVEY (1821-89). An American soldier in the Confederate service, and an educator, born in South Carolina. He graduated at West Point in 1842, and served in the Mexican War, for his gallantry in which he was brevetted major. He resigned in 1849, and became a professor in Washington College, Lexington, Va., and later filled a similar position in Davidson College, North Carolina. In 1859 he became superintendent of the North Carolina Military Institute, at Charlotte, but resigned in 1861 to enter the Confederate service. He commanded at the battle of Big Bethel, June 10, 1861, and was soon afterwards promoted to be a brigadier-general. He fought against McClellan in the Peninsular campaign, and was especially conspicuous at the battle of Seven Pines and Fair Oaks, May 31 and June 1, 1862. He was with A. P. Hill at the battle of Beaver Dam Creek, and participated in that of Gaines's Mill. At South Mountain, September 14, 1862, with only 9000 men, he managed to hold the whole Federal army in check until Lee was able to get his trains and artillery out of danger, and then joined the main army in time to take part in the battle of Antietam on the 17th. He was appointed a lieutenant-general by President Davis in July, 1863, and was placed in command of a corps in General Bragg's army, with which he fought at the battle of Chickamauga, September 19-20, 1863. In the last year of the war he fought under Joseph E. Johnston at the battle of Bentonville, N. C., and laid down his arms at Durham Station, on April 26, 1865. After the war he was for a number of years editor of a monthly magazine entitled *The Land We Love*, and later edited the *Southern Home*. From 1877 until 1884 he was president of the Arkansas Industrial University, and from 1885 until the year of his death of the Middle Georgia Military and Agricultural College. His publications include: *Elements of Algebra* (1858); a number of religious tracts; and several articles in *Battles and Leaders of the Civil War* (Johnson and Buel, editors, New York, 1887).

HILL, DAVID BENNETT (1843—). An American politician. He was born at Havana, N. Y.; was admitted to the bar in 1864, and practiced law at Elmira, N. Y. He was a Democratic member of the New York Assembly from 1869 to 1871, and was elected Mayor of Elmira in 1882. He early became prominent in State and National politics, and was chairman of the Democratic State Convention in 1877, and again in 1881, and in the following year was elected Lieutenant-Governor on the ticket with Grover Cleveland, upon whose resignation in 1885, preparatory to assuming the duties of the Presidency, he became Governor. He continued to hold this position until 1891, when he succeeded William M. Evarts as a member of the United States Senate, where he took a prominent part in the debates, especially in those concerning the Wilson Tariff Bill in 1894. During his Senatorial term he opposed various measures approved by President Cleveland, and was instrumental in preventing the confirmation by the Senate of the nominations of William B. Hornblower and Wheeler H. Peckham as justices of the United States Supreme Court. He was a prominent candidate for the Presidential nomination before the Democratic National Convention of 1892, and was defeated for Governor of New York in 1894 by Levi P. Morton. After the expiration of his term in the Senate (1897), Mr. Hill practiced law in Albany, though he continued to take an active part in politics.

HILL, DAVID JAYNE (1850—). An American author and educator, especially well known for his writings on rhetoric. He was born at Plainfield, N. J.; was educated at Bucknell University (then Lewisburg), where he was professor of rhetoric (1877-79), and then president. In 1888 he was made president of Rochester University. After resigning his office he spent three years in the study of public law and diplomacy in Europe, and was subsequently called to the office of Assistant Secretary of State in Washington. In 1903 he was appointed United States Minister to Switzerland. During his residence in Washington he held the professorship of European diplomacy in the School of Comparative Jurisprudence. His works include: *The Science of Rhetoric* (1877); *The Elements of Rhetoric and Composition* (1879); *Life of Washington Irving* (1879); *Life of William Cullen Bryant* (1880); *Principles and Fallacies of Socialism* (1885); *The Elements of Psychology* (1887); *The Social Influence of Christianity* (1887); *Genetic Philosophy* (1893); and an edition of Jevons's *Logic* (1884).

HILL, GEORGE BIRKBECK (1835-1903). An English author, born at Tottenham, Middlesex, and educated at Pembroke College, Oxford. From 1859 to 1876 he was head master of the Bruce Castle School; in the latter year he resigned to devote himself to literature. He is best known as a Johnsonian scholar and editor. His numerous published works include: *Dr. Johnson: His Friends and His Critics* (1878); *Life of Sir Rowland Hill* (1880); *Colonel Gordon in Central Africa* (1881); *Wit and Wisdom of Dr. Johnson* (1888); *Footsteps of Dr. Johnson in Scotland* (1890); *Writers and Readers* (1892); *Harvard College, by an Oxonian* (1894); *Talks About Autographs* (1896); *Johnsonian Miscellanies* (1897); *Life of Edward Gibbon* (1900). He edited: *Boswell's Correspondence* (1879); *Boswell's Life of Johnson* (1886); *Rasselas* (1888); *Select Essays of Dr. Johnson* (1889); *Letters of Johnson* (1892); *Letters of Dante Gabriel Rossetti* (1897); *Unpublished Letters of Dean Swift* (1899).

HILL, GEORGE WILLIAM (1838—). An American astronomer, born in New York, and educated at Rutgers College. He became an assistant on the staff of the *American Ephemeris* and of the *Nautical Almanac* in 1861, was elected to the National Academy of Sciences in 1874, and was awarded a gold medal by the London Royal Astronomical Society in 1887, for his work on the lunar theory. He wrote largely on celestial mechanics and mathematics, and contributed to the governmental *Astronomical Papers* (especially 1882, 1890, 1891, 1895), to the *Year Book* of the Agricultural Department (1898), and to the publications of the Washington Bureau of Navigation. His most valuable work is *A New Theory of Jupiter and Saturn* (1890).

HILL, HENRY BARKER (1849-1903). An American chemist, son of Thomas Hill, president of Harvard (1862-68), and born at Waltham, Mass. He was educated at Harvard and the University of Berlin. He was assistant in the chemical laboratory at Harvard (1870), assistant professor (1874), full professor (1884), and director of the chemical laboratory (1894), and was elected to the National Academy of Sciences in 1883. He contributed to its *Proceedings* (1881 sqq.), to the *American Journal of Chemistry*, to Silliman's *American Journal*, and to the *Berichte der deutschen chemischen Gesellschaft* (vols. ix.-xxxiii.), and wrote *Notes on Qualitative Analysis* (1874).

HILL, JAMES J. (1838—). An American railway promoter, born near Guelph, Ont. He was of Scotch-Irish descent, and left his father's farm for a business career in Minnesota. In 1870 he formed the Red River Transportation Company, which was the first to open communication between Saint Paul and Winnipeg. Eight years afterwards he helped to form the syndicate which, under another name, ultimately built the Canadian Pacific Railway. From 1883 to 1893 he interested himself in the building of the Great Northern Railway, extending from Lake Superior to Puget Sound, with northern and southern branches and a direct steamship connection with China and Japan. Mr. Hill gave $500,000 toward the establishment of a Roman Catholic theological seminary in Saint Paul, Minn.

HILL, JOHN HENRY (1791-1882). An American educator, chiefly identified with teaching and missionary work in Greece. He was born in New York City, graduated at Columbia College, and was ordained a deacon in the Protestant Episcopal Church in 1830. In the same year he went as a missionary to Greece, and at Athens he and his wife established a girls' school, afterwards a school for boys, and also a high school for the training of teachers. His work at first received little encouragement, but prospered after pupils from prominent and wealthy Greek families began to attend the school. Dr. Hill was chaplain of the British Legation in Greece from 1845 to 1875, and continued his teaching during that time. On his death, at Athens, the Greek Government, in recognition of his educational work among the women of Athens, buried him with the honors of a taxiarch, and the Athenian municipality erected a monument to his memory. Honorary degrees were conferred on him by Harvard and Columbia.

HILL, OCTAVIA (c.1836—). An English social reformer, born in London. At an early age she began her efforts to improve the homes of the London poor. She first began this work under Frederick D. Maurice, and later, in 1864, was associated with John Ruskin. The latter advanced the money for undertaking the scheme of owning the houses and improving them or erecting new ones. She taught multitudes to help themselves, impressing upon them ideas of cleanliness, order, and self-respect. Her publications include: *Homes of the London Poor* (1875), and *Our Common Land* (1878).

HILL, ROBERT THOMAS (1858—). An American geologist, who became connected with the United States Geological Survey in 1886. He was born at Nashville, Tenn., and in 1886 graduated at Cornell University. During his explorations on the southern borders of the United States and Mexico, and in Central America and the West Indies, he demonstrated the existence of the Lower Cretaceous formations in the United States, and proved that artesian wells might be procured over a vast area of Texas. In addition to his chief work, *Cuba and Puerto Rico, with Other Islands of the West Indies* (1898), his publications include many papers on the original relations of the Antilles, contributed to the *Proceedings* of scientific societies of which he became a member. For two years he was professor of geology at the University of Texas.

HILL, ROWLAND (1744-1833). An English preacher of great popularity. His father was a baronet, and he was born at Hawkstone Park, Shropshire, on the border of Wales, August 23, 1744. He graduated B.A. at Cambridge in 1769, and while there made the acquaintance of Whitefield, preached in the surrounding villages before taking orders, and conducted religious services in the houses of the sick and poor. He was appointed in 1773 to the parish of Kingston, Somersetshire, where he preached in the open air and attracted great crowds to the services which he held nearly every day of the week. Having, on the death of his father in 1780, inherited considerable property, he built for his own use Surrey Chapel, on the Blackfriars Road, London. The chapel was opened June 8, 1783. Although he now occupied a position as a dissenting minister, Hill conducted his services in accordance with the forms of the Church of England, in whose communion he always remained. His chapel soon became filled with a larger congregation than any other in London. In the summer months he made what he called 'gospel tours' into all parts of the country, sometimes extending them to Scotland and Ireland, attracting, wherever he went, crowded and interested audiences. After these tours he used to return to his duties at the Surrey Chapel, where he continued to officiate to the end of his life. He published accounts of two journeys through England and Scotland (1799 and 1800); a very popular hymn-book (1783); numerous sermons, but especially *Village Dialogues* (1801, 34th ed. 1839). He was among the founders of the Religious Tract Society and the British and Foreign Bible Society, an early and courageous defender of vaccination, and himself vaccinated thousands of persons. He wrote in favor of the practice, *Cow-pock Inoculation Vindicated and Recommended from Matters of Fact* (London, 1806). He died in London, April 11, 1833. His life has been written several times: by Sidney (4th ed. London, 1844); Sherman (London, 1857); Charlesworth (London, 1879).

HILL, ROWLAND, Viscount (1772-1842). An English soldier, nephew of the preacher of the same name, born at Prees Hill, Shropshire. He entered the army when he was fifteen, and studied a year at Strassburg. He served under Abercrombie in Egypt (1801), and accompanied Wellesley to Portugal in 1808. Throughout the Peninsular War he showed ability second only to his chief's. In 1811 he utterly defeated the French army at Cáceres, and in 1812 he took the fortress of Almarez, thus separating the two French armies. At Vitoria, in 1813, his forces made the initial attack, and in the same year, on the Nive, he again defeated the French. He had been promoted to lieutenant-general in 1812; two years later he was created Baron Hill of Almarez and Hawkstone, and received an annual grant from Parliament of £2000. During the Hundred Days he was no less active and prominent. After a diplomatic errand to the Prince of Orange, he commanded a division in the allied army. His horse was shot under him at Waterloo, and he was so stunned that, in the thick of the fight, he was for some time lost and supposed to have been killed. Hill remained with the army of occupation in France as second in command. He was promoted general in 1825, and three years later succeeded Wellington as commander-in-chief; but in 1842 he resigned, because of failing health, and turned over the command to Wellington. He became viscount in the same year, a few months before his death.

HILL, Sir ROWLAND (1795-1879). The reformer of the English postal system. At twelve he became a teacher in his father's school at Birmingham, and before he reached his majority he had organized a remarkable system of discipline which came to be known as the Hazelwood method (from the name of the school). This system was described by his elder brother, Matthew Davenport Hill, in a pamphlet entitled *Public Education: Plans for the Government and Liberal Instruction of Boys in Large Numbers* (1822). The school became widely popular, and was carried on with success by the family. Rowland finally withdrew, however, partly because he recognized the defects of his scholarship, and partly because he was oppressed by the religious observances required. He thought of joining Robert Owen in his communistic schemes, but in 1833 became secretary of the commission for colonizing South Australia. From childhood he had a strong bent toward invention. About this time he devised a successful rotary printing-press; but it was not then adopted, because the Treasury demanded that each single sheet for a newspaper should be previously stamped, and forbade the attaching of the stamps by machinery. But his great work was that of securing the adoption of penny postage. The franking privilege was widely used by members of Parliament and high officials for themselves and their friends. The great body of the people, however, sent few letters, and postage on them had to support the whole service. Rates depended upon distance, and as they were rarely prepaid, to receive a letter was often a hardship. Under this system, rates of postage were advancing and postal revenues diminishing. After making a careful study of the statistics, in 1837 Hill published a pamphlet, *Post-Office Reform,* in which he recommended a penny rate for half-ounce letters, regardless of distance, inside the United Kingdom, and the use of adhesive stamps. His plan was adopted, and in 1840 he was given an appointment in the Treasury, where, against great opposition, he was working out the system when he was dismissed by a change of Ministry. In 1846 a fund of £13,000 was raised by public subscription for him. The same year the Whigs again came into office, and he was made secretary to the Postmaster-General, and in 1854 chief secretary. In 1864 he retired on full salary, and received a Parliamentary grant of £20,000. He wrote a *History of Penny Postage.* This was published in 1880, with an introductory memoir by his nephew, Dr. G. Birkbeck Hill.

HILL, THOMAS (1818-91). An American educator and Unitarian clergyman, born in New Brunswick, N. J., of English parentage. He was left an orphan when about ten years old, and in 1830 was apprenticed to a printer for a term of three years. He spent the year 1834-35 at the Lower Dublin Academy, near Philadelphia, where his eldest brother was principal, and then apprenticed himself to an apothecary in New Brunswick. In 1839 he decided to go to college, and entered Harvard the following year, in the class of 1843. His preëminence in mathematics won him an offer of a high position at the National Observatory in Washington; but he intended to go into the ministry, and, contrary to the advice of his professors, entered the divinity school, from which he graduated in 1845. For the next fourteen years he was pastor of the Unitarian Church in Waltham, Mass. In 1859 he succeeded Horace Mann as president of Antioch College. Although the college was in such financial straits that he was obliged to supplement his salary by preaching in Cincinnati, 70 miles distant, he continued his services until elected president of Harvard in 1862. The elective system and the academic council were instituted during his administration, and the lectures of the university were at this time first opened to the public. Failing health compelled him to resign in 1868. In 1871 he was elected to the Legislature. In the same year he went to South America with Louis Agassiz. On his return he accepted a call to the First Parish Church in Portland, Maine. He was a man of unusual versatility, and gained distinction in many of the pursuits in which he interested himself. He was one of the foremost natural scientists of the time, and an accomplished classical scholar, as well as a mathematician. He invented several mathematical machines, among which his occultator is of the most importance, and made valuable contributions to the knowledge of curves in simplifying their expression and in discovering new forms. Besides publishing essays, text-books, and volumes of sermons, he edited Eberty's *Stars and the Earth* (1849), and wrote *Christmas and Poems on Slavery* (1843); *Geometry and Faith* (1849); *Curvature* (1850); *Jesus the Interpreter of Nature, and Other Sermons* (1870); *Statement of the Natural Sources of Theology, with Discussion of Their Validity, and of Modern Skeptical Objections* (1877); *In the Woods and Elsewhere,* verse (1888).

HILL, THOMAS (1829—). An American painter, born in Birmingham, England. He came to America in 1841. He studied in Paris under Paul Meyerheim for several months, but beyond this instruction was self-taught. His first important work was the "Yosemite Valley," which was published in chromo by Prang. His other pictures include: "White Mountain Notch;" "The Home of the Eagle;" "Donner Lake;" and the "Grand Cañon of the Sierras."

HIL'LAH, or **HEL'LA.** The capital of a sanjak in the Vilayet of Bagdad, Asiatic Turkey, situated on the Euphrates, not far from the ruins of Babylon, from which most of its building material has been taken (Map: Turkey in Asia, L 6). It is rather poorly built, but has a large number of mosques, and is a stopping-place for pilgrim caravans on the way to the holy cities of Meshhed-Ali and Meshhed-Hussein. It has some manufactures of cotton goods and woolen mantles. The population is estimated at about 10,000, largely Arabs.

HIL'LARD, GEORGE STILLMAN (1808-79). An American lawyer and author. He was born in Machias, Maine; graduated at Harvard in 1828; studied law and acquired an extensive legal practice in Boston. He also served in the State Legislature, and from 1866 to 1870 was United States District Attorney for Massachusetts. At earlier periods he collaborated with George Ripley in editing the *Christian Register,* a Unitarian paper, and with Charles Sumner in publishing the *Jurist.* In 1856 he bought an interest in the Boston *Courier,* and was for some time associated in its editorial management. Among his numerous works are: *Six Months in Italy* (1853); *Life and Campaigns of George B. McClellan* (1864); and, with Mrs. Ticknor, a *Life of George Ticknor* (1873). He also edited *The Poetical Works of Edmund Spenser* (5 vols., 1839).

HILLEBRAND, hĭl'le-brānt, JOSEPH (1788-1871). A German philosopher and historian of literature, born at Grossdüngen, near Hildesheim. He was originally a Catholic, studied at Hildesheim and at Göttingen, and in 1815 entered the priesthood and taught at Hildesheim, but resigned his position on accepting Protestant views. Upon Hegel's departure from Heidelberg in 1818, he was appointed professor of philosophy there, and in 1822 took a like position at Giessen. He was President of the Lower House of the Hessian Chamber in 1848. His most important work in the field of literary history was *Die deutsche Nationallitteratur seit dem Anfang des 18. Jahrhunderts* (3d ed. 1875). Of less importance are his philosophical works, which show tendencies toward the views of Jacobi: *Die Anthropologie als Wissenschaft* (1822-23); *Lehrbuch der theoretischen Philosophie und philosophischen Propädeutik* (1826); *Litterarästhetik* (1826); *Uni-*

versalphilosophische Prolegomena (1830); *Der Organismus der philosophischen Idee* (1842); and *Philosophie des Geistes* (1835).

HILLEBRAND, Karl (1829-84). A German historian and publicist. He was born in Giessen, and studied law there and at Heidelberg. He was imprisoned for participation in the insurrection at Baden in 1849, but escaped to France and completed his studies at the University of France and the Sorbonne. He next taught German at the Military Academy at Saint Cyr, and in 1863 was appointed professor of foreign literature at Douai. At the outbreak of the Franco-German War he went to Italy as correspondent of the London *Times* and settled at Florence. He contributed numerous articles to French, English, Italian, and German periodicals, and published many separate works, including the prize essay *Des conditions de la bonne comédie* (1863); *La Prusse contemporaine et ses institutions* (1867); *Zeiten, Völker und Menschen. Gesammelte Aufsätze* (1874-85); *Geschichte Frankreichs von der Thronbesteigung Ludwig Philips bis zum Fall Napoleons III.* (1877-79); and *Lectures on German Thought During the Last Two Hundred Years* (1880). Consult Homberger, *Karl Hillebrand* (Berlin, 1884).

HILLEBRANDT, Alfred (1853—). A German Sanskrit scholar, born at Grossnädlitz. He studied at Breslau and Munich, and became professor in the former university. His especial branch of study is Vedic mythology. *Varuna und Mitra* (1877) was a prologue to his great work *Vedische Mythologie* (1891-1902). Hillebrandt also wrote: *Das altindische Neu- und Vollmondsopfer* (1880); *Vedachrestomathie* (1885), a section on religious antiquities in Buhler's *Grundriss der indo-arischen Philologie und Altertumskunde* (1897); and *Alt-Indien, Kulturgeschichtliche Skizzen* (1899).

HIL'LEL, called Hababli ('the Babylonian'), or Hazzaken ('the elder'). A Jewish rabbi who died a few years after the beginning of the Christian Era. By birth a Babylonian, he left his home and came to Jerusalem to study the law. By doing manual labor he was enabled to support himself while attending the lectures of Shemayah and Abtalion, the president and vice-president respectively of the Sanhedrin. His progress was rapid. His solution of a difficulty which arose concerning the lawfulness of slaughtering the Paschal Lamb on the Sabbath led to his being appointed president of the Sanhedrin (B.C. 30), and he held this position till about A.D. 10. Hillel's character was gentle, patient, and peace-loving. It is Hillel to whom is ascribed the maxim, "What is hateful unto thee do not unto others." He plays an important part in the history of Jewish legal science. He introduced a set of seven rules, by which the Scriptures are to be interpreted and laws derived from them. Entirely the opposite of Hillel in character was Shammai (q.v.), the vice-president of the Sanhedrin. His teaching was marked by a strict adherence to the letter and great vigor. The difference between the leaders was continued by their followers, so that, years afterwards, we still encounter the school of Hillel and the school of Shammai. The honor and respect won by Hillel was so great that his position of president of the Sanhedrin remained in his family.—Hillel Hannasi ('the prince'). A descendant of the preceding, who lived about A.D. 350. He was also president of the Sanhedrin and had charge of the school at Tiberias. His great work was the arranging of the Hebrew calendar. In this he followed the system instituted by Meton.

HIL'LER, Ferdinand (1811-85). An eminent German pianist, conductor, and composer, born at Frankfort. From early boyhood he was a student of music, his concert début taking place at ten years of age, followed two years later by the production of his first composition. His first teachers were Hofmann for the violin, Aloys Schmitt for the pianoforte, and Vollweiler for harmony and counterpoint. Later (1825) he became a pupil of Hummel at Weimar. For seven years (1828-35) he was engaged as teacher of composition at Choron's School of Music, Paris, but eventually gave up his position so that he might better equip himself as a pianist and composer. He returned to Frankfort the following year (1836), and devoted himself to composition. His abilities were recognized, and although but twenty-five, he was asked to act as conductor of the Cäcilienverein during the illness of Schelble. He had by this time attracted the notice of Rossini and Mendelssohn, the former assisting him to launch his first opera, *Romilda* (which was a failure), at Milan, and the latter obtaining for him the entrée to the Gewandhaus, and affording an opportunity for the public presentation of his oratorio *Die Zerstörung Jerusalems* (1840). After a year of study in Church music at Rome, he returned to Leipzig, and during the season of 1843-44 conducted the Gewandhaus concerts. By this time his position in the musical world was established, and honors and appointments were showered upon him. He became municipal kapellmeister of Düsseldorf in 1847, and in 1850 received a similar appointment at Cologne, in which latter city he founded the well-known Cologne Conservatory. He was conductor at the Italian Opera in Paris during the season of 1852-53. Meanwhile he had increased his reputation and prestige by his conductorship of the Gürzenich concerts and the Lower Rhine music festivals. He was elected a member of the Royal Academy of Fine Arts, Berlin, in 1849, and in 1868 received the title of doctor from the University of Bonn. As a composer Hiller ranks high, not for the magnitude and depth of his work, but for its poetry, elegance, and rhythmic melody. His compositions include operas (six), none of them of more than local significance; six cantatas, one or two of which have been popular in England, and one (*The Lorelei*) occasionally heard in America. Other works comprise pieces in every form and variety of composition. He was also a very successful lecturer and a forceful writer, his contributions to reviews and newspapers having been since collected in book form. He also published among others: *Musikalisches und Persönliches* (1876); *Wie hören wir Musik?* (1880); *Goethes musikalisches Leben* (1880); and *Erinnerungsblätter* (1884). He died at Cologne.

HILLER, Johann Adam (1728-1804). An important German dramatic composer, born at Windisch-Ossig, near Görlitz. He was of musical parentage, and was endowed with a fine soprano voice, which obtained for him a course of free instruction at the Görlitz Gymnasium, from which he went to the Kreuzschule at Dresden, where he became a pupil of Homilius for pianoforte and thorough-bass. Later he went to Leipzig for study at the university, and while there earned a bare existence as flutist and singer in local concerts and by private teaching. His first good fortune came with his appointment as tutor to the son of Count Brühl at Dresden, with whom he went in 1758 to Leipzig. It was during his stay here at this time that he conceived the idea of reviving the old subscription concerts, an attempt which ultimately led to the founding of the famous Gewandhaus concerts, of which he was the first conductor. From 1789 to 1801 he was music director of the Thomasschule. He also founded a singing school in 1771. To him has been given the credit of being the originator of the *Singspiel*, the beginning of German comedy opera as distinct from the French and Italian developments. The most important of these were: *Lottchen am Hofe* (1760); *Der Teufel ist los* (1768); *Poltis, oder Das gerettete Troja* (1782). The lyrics of all his *Singspiele* were of considerable musical value, and have been long popular. Among his sacred compositions are: *A Passion Cantata; Funeral Music in Honor of Hasse;* the one hundredth Psalm; and a few symphonies. He also edited many important collections of music, and wrote considerably concerning musical topics. He was one of the most important German musical scholars and writers of the eighteenth century. He died at Leipzig.

HIL'LERN, Wilhelmine von (1836—). A German novelist, born at Munich, daughter of the popular dramatist Charlotte Birch-Pfeiffer. She is best remembered for her satire of blue-stockings in *Der Arzt der Seele* (1869), and for a charming tale of Freiburg-im-Breisgau in Reformation days, *Höher als die Kirche* (1876). Worthy of mention also are *Die Geier-Wally* (1873), cleverly dramatized by her in 1881, and the Black Forest sketches *Ein Blick ins Weite* (1897).

HILL FORTS. Defensive positions on hills. The customs of early groups of people as to defensive locations for residence on elevations have determined the foundation of many of the most famous cities. Hill forts of various periods from the most ancient are common throughout the world, and refer to the monuments and settlements of small groups of men, both securing them from attack and forming a base for industrial occupations and forays. Rome, Athens, and Jerusalem were such hill forts. Settlements on plains or shores represent either times or localities of greater security or the weight of large bodies of men discounting attack, and they supply the means of building great artificial fortifications. The history of nearly every nation gives evidence of this period, and these forts are still found among the more primitive tribes, especially in India.

HILL'HOUSE, James (1754-1832). An American legislator, born at Montville, Conn. He graduated at Yale in 1773 and practiced law. He took an active part in the war of the Revolution, and when New Haven was attacked by the English under Tryon in 1779, was captain of the Governor's Guards. He became a Federalist member of Congress in 1791, and from 1795 to 1810 was a member of the United States Senate. In 1815 he was a member of the Hartford Convention. That New Haven is known as the 'Elm City' is largely due to Senator Hillhouse, who set out with his own hands many of these trees.

HILLHOUSE, James Abraham (1789-1841). An American poet. He was born in New Haven, Conn., the son of Senator James Hillhouse, graduated at Yale in 1808, and for some time was engaged in business in New York City. After 1822 he devoted himself almost wholly to literature. His chief works are: *The Judgment: A Vision* (1812), and the dramas *Percy's Masque* (1820) and *Hadad* (1825). An edition of his works was published in two volumes in 1839. His heavy, ambitious dramas were once highly praised.

HILLIARD, hĭl'yẽrd, Francis (1806-78). An American jurist, born in Cambridge, Mass. He graduated at the Harvard Law School in 1823, and served for a time as judge, but is known principally as a writer of legal text-books. His best-known works are: *American Law of Real Property* (2d ed. 1846); *American Jurisprudence* (2d ed. 1848); *Law of Mortgages of Real and Personal Property* (1853); *Treatise on Torts* (1859); and *The Law of Injunctions* (1864).

HILLIARD, Henry Washington (1808-92). An American lawyer, born in Fayetteville, N. C. He graduated in 1826 at South Carolina College, and was admitted to the bar in 1829. From 1831 to 1834 he was a professor in the Alabama University, Tuscaloosa, and in 1838 was elected to the State Legislature. In 1842-44 he was chargé d'affaires in Belgium, and from 1845 to 1851 was a member of Congress from Alabama. He opposed the secession of the South, but subsequently accepted the posts of commissioner to Tennessee and brigadier-general in the provisional Confederate Army. From 1877 to 1881 he was United States Minister to Brazil. He published: *Roman Nights*, from the Italian (1848); *Speeches and Addresses* (1855); and *De Vane* (1865).

HILL MUSTARD. See Bunias.

HILL-MYNA (*hill* + *myna*, from Hindi *mainā*, starling). The common name, in India, of the 'grakles' of the family Eulabetidæ. These starling-like birds belong to the group called 'glossy starlings,' and especially to the genus Eulabetes. They are birds of moderate size and glossy black plumage, marked by fleshy yellow or orange wattles on the head. The shortness and squareness of the tail are noticeable. The best-known species is that of Southern India and Ceylon (*Eulabetes religiosa*), which is distinguished from the others by two long patches of bare skin on the neck; also by a white spot at the base of the wing-quills. They live in the forest and feed on small fruits. They are excellent mimics, learn easily to whistle and talk, and are not only highly prized as cage-birds in India, but are exported in large numbers. Other species are known in Northern India and eastward. See Myna-Bird.

HILL-PARTRIDGE, or Tree-Partridge. One of a numerous group of partridges (genus Arboriphila) which frequent elevated forested regions from the Himalayas eastward to Formosa. They are mostly of very dark colors. The plumage is alike in both sexes, and the eggs are pure white. They frequently alight on trees when flushed by dogs, but live upon the ground like other partridges. They are favorite game birds in Northern India.

HILLSBORO, hĭlz′bŭr-ō. A city and the county-seat of Montgomery County, Ill., 61 miles northeast of Saint Louis, Mo.; on the Cleveland, Cincinnati, Chicago and Saint Louis Railroad (Map: Illinois, C 4). Among its industrial establishments are a coal-mine, flour and woolen mills, furniture and carriage factories, etc. Population, in 1900, 1937.

HILLSBORO. A village and the county-seat of Highland County, Ohio, 60 miles east of Cincinnati; the terminus of branches of the Baltimore and Ohio Southwestern and the Norfolk and Western railroads (Map: Ohio, C 7). It has a public library of 7500 volumes, and a handsome soldiers' monument of granite. The manufactures include lumber, furniture, flour, foundry products, etc. The water-works are owned by the municipality. Population, in 1890, 3620; in 1900, 4535.

HILLSBORO. A city and the county-seat of Hill County, Tex., 34 miles north of Waco; on the Saint Louis Southwestern and the Missouri, Kansas and Texas railroads (Map: Texas, F 3). It is the centre of a fertile agricultural district, with an important trade in cotton, grain, live stock, and hides, and has cotton gins and compresses, a cotton-mill, a cottonseed-oil mill, flour and planing mills, and manufactures of hosiery, garments, novelties, candy, hay-presses, etc. The water-works are owned by the municipality. Population in 1890, 2541; in 1900, 5346.

HILLSBOROUGH, hĭlz′bŭr-ō. A seaport town of Albert County, New Brunswick, Can.; on the right bank of the Petitcodiac estuary, just above its outlet into Shepody Bay, 24 miles by rail from Salisbury (Map: New Brunswick, E 4). It has manufactures of plaster, which, with mineral oil from the depleted 'Albertite' coal-mines in the neighborhood, it exports in considerable quantities to the United States. The town was founded in 1763 by a member of the Steeves family, of whom there are now 700 representatives in a population of 3000.

HILLSBOROUGH, WILLS HILL, Earl of (1718-93). A British statesman, first Marquis of Downshire, a native of Fairford, Gloucestershire. He was elected to Parliament for Warwick in 1741, and the following year succeeded his father as Lord Lieutenant of Downshire. He became a peer of Ireland in 1751, but went from the Irish to the English Privy Council (1754), George II. having made him comptroller of his household. After entering the English House of Lords (1756), he held various political appointments. While Secretary of State for the Colonies (1768), his stubbornness and bad judgment made much mischief between them and the mother country, and he showed but little more tact in advocating the union of England and Ireland. He was said to have been a model Irish landlord. At the conclusion of his first letter, Junius mentions Lord Hillsborough as one of the ministers responsible for the American crisis.

HILLS′DALE. A city and the county-seat of Hillsdale County, Mich., 90 miles southwest of Detroit, on the Lake Shore and Michigan Southern Railroad (Map: Michigan, J 7). It is the centre of a fertile agricultural and stock-raising region, and manufactures fur and fur-lined overcoats, flour, window-screens and screen doors, furnaces, wooden novelties, tables, wagon-wheels, etc. The city has a beautiful private park, and south of the city limits is Baw Beese Park, a popular summer resort. Hillsdale College (Free Baptist) was established here in 1855. Hillsdale, settled about 1840, is governed under a charter of 1896, by a mayor elected annually and a unicameral council, of which the executive is a member. The city owns and operates its water-works and electric-light plant. Population, in 1890, 3915; in 1900, 4151.

HILLSTAR. Any humming-bird of the genera Diplogena and Oreotrochilus. These are among the largest of the tribe, very gay in color, and inhabit the Andes from Ecuador to Bolivia. Those of the former genus are remarkable for their brilliant crown spots. In the latter genus are many species, each of which is limited in its range to a single mountain, or very limited area of high elevation. See HUMMING-BIRD.

HILL-TIT. One of a numerous family (Leiotrichidæ) of small insect and berry eating birds, often brightly colored, which inhabit the Himalayan region and eastward. Among them is the red-billed hill-tit (*Leiothrix lutea*), which is widely dealt in as a cage-bird under the name 'Japanese robin,' though it is unknown in Japan. It has brilliant colors, a sweet song, and gentle manners.

HILMEND, hĭl′mend. See HELMUND.

HILO, hē′lō. The second town in size and the best seaport of the Hawaiian group, situated on Hilo Bay, on the eastern coast of the island of Hawaii (Map: Hawaii, F 4). It has a protected harbor with a lighthouse, and contains a court-house, a custom-house, and a library. The town is surrounded by luxuriant tropical forests, with extensive lava-fields in the vicinity. There are delightful drives, and an excellent carriage-road winds from the town up toward the crater of Kilauea. The population (district, 19,785 in 1900) is extremely heterogeneous, and the American element is prominent.

HILONGOS, or **ILONGOS,** ē-lōng′ōs. A town on the island of Leyte, Philippines, situated on the southwestern shore, 96 miles from Tacloban (Map: Philippine Islands, J 9). Population, 13,800.

HILPRECHT, hĭl′prĕkt, HERMANN VOLLRAT (1859—). An Assyriologist, born at Hohenerxleben, Germany, and educated at Bernburg and Leipzig. In 1885 he was repetent in Old Testament theology at Erlangen, and in the following year came to Philadelphia to become editor of the Oriental department of the *Sunday-School Times.* Afterwards he was appointed professor of Assyrian in the University of Pennsylvania. He studied the Assyrian inscriptions (1882) in the British Museum, traveled in Syria, Babylonia, and Asia Minor, and became an authority on cuneiform paleography, so that the Turkish Government made him head of the Babylonian department of the Imperial Museum in Constantinople. In 1888 he accompanied the University of Pennsylvania's expedition to Nippur, but returned the following year. Many of the documents found after his departure were sent to him, and in 1900 he returned to Nippur, and soon after was put in charge of the excavations, the results of which had much scientific importance. (See NIPPUR.) His main works are: *Freibrief Nebuchadnezar's I.* (1883); *Assyriaca* (1894); *Old Babylonian Inscriptions, Chiefly from Nippur* (1893—); *Business Documents of Murashû Sons, of Nippur* (1898); and many contributions to the *Theologisches Litteraturblatt* and other theological and Oriental journals.

HILTED (from Eng., AS. *hilt*, Icel. *hjalt*, OHG. *helza*, hilt; probably connected ultimately with *hold*). A term used in heraldry (q.v.) to indicate the tincture of the handle of a sword.

HILTL, hĭl′t'l, JOHANN GEORG (1826-78). A German actor and author, born in Berlin. After studying for the stage and acting in Hanover from 1843 to 1845, he was engaged at the Berlin Court Theatre, of which he was the manager from 1854 to 1861. His best acting was in seriocomic parts. He translated many French dramas, and wrote a series of historical novels which had considerable popularity, though they lacked permanent literary value. The best known of these are: *Gefahrvolle Wege* (1865); *Unter der roten Eminenz* (1869); *Der alte Derfflinger und seine Dragoner* (1871); *Das Roggenhauskomplott* (1873); *Die Damen von Nanzig* (1874); and *Auf immer verschwunden* (1878). His works on history are: *Der böhmische Krieg und der Mainfeldzug* (4th ed. 1873); *Der französische Krieg von 1870-71* (7th ed. 1895); *Preussische Königsgeschichten* (1875); *Unser Fritz* (5th ed. 1891); and *Der grosse Kurfürst und seine Zeit* (3d ed. 1893).

HILTON, WILLIAM (1786-1839). An English painter, born at Lincoln. He was a pupil of Raphael Smith, the engraver, and studied in the Royal Academy, where his first work was exhibited in 1803. In 1827 he was appointed keeper of the academy. Hilton's paintings were better appreciated by men of his own profession than by the general public, and because of his over-use of asphaltum, they have lost in color. Nevertheless the following are in color and composition notable pictures: "Christ Crowned with Thorns" (1825), in South Kensington; "Sir Calepine Receiving Serena" (1831) and "Edith Discovering the Body of Harold" (1834), both in the National Gallery; "Una with the Lion," "The Crucifixion," "The Murder of the Innocents" (1838), and a portrait of Keats.

HILVERSUM, hĭl′vĕr-sŭm. A town in the Province of North Holland, Netherlands, 18 miles southeast of Amsterdam (Map: Netherlands, D 2). It contains a number of textile mills, and is a favorite summer resort for Amsterdam residents. Population, in 1889, 12,393; in 1899, 19,443.

HIMALAYA, hĭ-mä′lȧ-yȧ (Skt., the abode of snow, from *hima*, snow + *ālaya*, abode). In South Central Asia, the most elevated and stupendous mountain system on the globe (Map: India, D 3). It is not, as sometimes represented, a single chain, but a system, consisting of several parallel and converging ranges, with a vast number of rugged, snowy peaks, separated by great elevated valleys and plateaus. On the north the system descends to the elevated plateau of Tibet; on the south to the depression drained by the Ganges and the Indus. The system starts with the Karakorum, in the Pamirs, whence it trends southeast and east, sweeping in a broad curve, convex southward. The mass of the Himalaya proper extends from the great bend of the Indus in the west to the great bend of the Brahmaputra in the east, or from longitude 73° 23′ to 95° 40′ E., a distance of nearly 1500 miles. Their average breadth is about 150 miles. The mean elevation of the range is from 16,000 to 18,000 feet, but 45 of its peaks are now known to exceed 23,000 feet in height. Of these, there are in Kumaon, Nanda Devi, 25,600 feet; in Nepal, Dhawalagiri, 26,826 feet; Mount Everest, 29,002 (the highest known point on the globe); in Kashmir, Mounts Godwin-Austen, 28,278; Gusherbrum, 26,378; Masherbrum, 25,600; and Kakapushi, 25,560 feet; in Bhutan, Chumalari, 23,946 feet, and Kutha Kangir, 24,740 feet; and on the borders of Sikkim and Nepal, Kunchinjinga, 28,156 feet, for a long time thought to be the second summit of the entire system. The southern base of the Himalaya comprises three distinct regions—first, adjoining the plains of Hindustan, the *Terai*, a jungle or grass-covered marshy plain; next, the great belt of *Saul Wood*, stretching along a great part of the range; and beyond it the *Dhuns*, a belt of detritus, extending to the foot of the true mountains. In the foothills above these regions, which are extremely unhealthy, are placed the sanitaria for troops—Darjeling, Simla, Murree. The first is connected by a mountain railway with the Bengal system. There are no plains and but few lakes of large size in the Himalaya; the chief of the latter are Naini Tal, in Kumaon, 6520 feet, and the lake of Kashmir, 6125 feet above the sea. Small glacial lakes are abundant in the heads of the gorges.

Snow falls at rare intervals in the mountains as low as 2500 feet, but at 6000 feet it snows every winter. The limit of perennial snow in the main or central Himalaya is 16,200 feet on the south and 17,400 feet on the north side; an anomaly probably owing to the dry atmosphere of Tibet, and the small quantity of rain and snow that falls there. The high range of the Himalaya forms a vast screen, which intercepts and condenses nearly all the moisture carried by the southwest monsoons from the Indian Ocean, and deposits it on the southern face of the mountains; hence at Cherra Punji, 4200 feet above the sea, as much as 600 inches of rain has been known to fall in one year. Glaciers are found in every part of the range above the snow-line; one of these, that of Deotal in Garhwal, is 17,945 feet above the sea. Among the largest of the glaciers are the Baltoro (33 miles in length) and Biafo, in the Karakorum Range. The passes in the Himalaya are the most elevated of the globe, and the greater number are upward of 17,000 feet in height. The highest known is Ibi-Gamin Pass into Garhwal, 20,457 feet, and the highest used for traffic is the Parang Pass in Spiti, 18,500 feet above the sea. All the passes above 16,000 feet are closed with snow from November till May. While the upheaval of the system probably commenced in early geologic times, the principal uplift occurred in the middle or late Tertiary period, in the mountain-making epoch which was signalized by the elevation of the alpine system of Europe. The geological structure of the Himalaya consist of crystalline rocks, with granite, gneiss, and a schistose formation, comprising micaceous, chloritic, and talcose schists. Earthquakes are of frequent occurrence in the central range. The Sanpo or Brahmaputra and Indus—which rise in close proximity to one another on the Tibetan side of the Himalaya—with their magnificent tributaries, derive their chief supplies from the melting of the snows of these mountains, and consequently are in flood at the hottest season of the year, when the moisture they supply is most needed. Trees and cultivated grains ordinarily attain their highest limits in the mountains at 11,800, and shrubs at 15,200 feet above the sea, a limited number of flowering plants attaining to 19,500 feet. The tea-plant can be cultivated along the entire southern face of the Himalaya to an elevation of 5000 feet, but the best is produced at from 2000 to 3000 feet above the sea. Tigers and apes are found at an elevation of 11,000, and the leopard at 13,000 feet, while the dog follows the herds over passes 18,000 feet high. Snakes are found at an elevation of 15,000 feet, but the highest limit of the mosquito is 8000 feet above the sea.

On account of the majestic height of this mountain range, and the apparent impossibility of reaching its summit, the imagination of the ancient Hindus invested it with the most mysterious properties, and connected it with the history of some of their deities. In the Purânas (q.v.) the Himalaya is placed to the south of the fabulous mountain Meru, which stands in the centre of the world (see Meru), and described as the king of mountains, who was inaugurated as such when Prithu was installed in the government of the earth. As the abode of Siva, he is the goal of penitent pilgrims, who repair to his summit in order to win the favors of this terrific god. His wife was Mena, whom the Pitris or demigods engendered by the mere power of their thought.

HIMALAYAN SUBREGION. A faunal district of the Oriental region (q.v.), also styled 'Himalo-Chinese,' because its most characteristic forms occur along the lower slopes of the Himalaya Mountains and their extension into China. See Indo-Chinese Subregion.

HIMEJI, hē-mä'jē. The capital of the Japanese Province of Harina, situated in the southern part of Hondo, 34 miles by rail from Kobe and at the junction of three highways (Map: Japan, D 6). It has a well-preserved castle dating from the fourteenth century, and the second in size in Japan. Cotton and stamped leather are among the products. Population, in 1898, 35,282.

HIM'ERA (Lat., from Gk. Ἱμέρα). A city on the north coast of Sicily, founded B.C. 649 by colonists from Zancle (Messana) and exiles from Syracuse. In B.C. 481-80 the tyrant Terillus, being expelled by Theron of Agrigentum, invoked the aid of the Carthaginians. They sent a large army under Hamilcar, but were totally defeated at Himera by the Greeks under Gelon of Syracuse. Thrasydæus, son of Theron, brought a large body of Doric emigrants to the city in 476; but a few years later, after the death of Theron, Thrasydæus was driven from Agrigentum by Hiero, and Himera became free. It seems to have enjoyed great prosperity during the remainder of the fifth century, but in 409 was razed to the ground by the Carthaginians. A new city, Thermæ Himerenses, was founded in B.C. 407 close to the former site. This name was derived from the famous hot spring in which Hercules was said to have bathed. The new city remained in Carthaginian hands until it was taken by the Romans during the First Punic War. It was peculiarly favored by them, and was left a free city under its own laws. In the time of Cicero it was a flourishing town, though not very large. Under Augustus it became a colony. Ergoteles, an Olympian victor, celebrated by Pindar, was a citizen of Himera. Stesichorus the poet was a native of the city, and his statue was preserved at Thermæ in the time of Cicero. Agathocles, the great tyrant of Syracuse, was a native of Thermæ.

HIME'RIUS (Lat. from Gk. Ἱμέριος) (c.315-c.386). A Greek teacher of rhetoric. He was born at Prusa, in Bithynia, and lived for some time at Antioch at the Court of the Emperor Julian, but settled in Athens as a teacher. Among his pupils were Gregory Nazianzen and Basil the Great. He was a pagan, but did not attack Christianity. His works, of which twenty-four orations are preserved (edited by Dübner, 1849), were in a florid, artificial style. They are valuable because of references to events of the time or quotations from a more classic period, especially from the lyric poets.

HIM'EROS (Lat., from Gk. Ἵμερος). In Greek mythology, the personification of longing and desire. He is the companion of Eros and of Aphrodite.

HIMIL'CO (Phœnician, 'grace of Milkar,' Gk. Ἱμίλκων, *Himilkōn*). A Carthaginian general, son of Hanno, who commanded the expedition against Sicily, B.C. 406, and conquered the western part of that island. When Dionysius of Syracuse renewed the war, B.C. 397, Himilco again commanded the Carthaginians, at first with success, but subsequently Dionysius assaulted him when greatly disabled by pestilence, and forced him to capitulate. Himilco abandoned his allies and mercenaries to the mercy of the enemy, and paid a large gratuity for permission to withdraw with his native Carthaginians. The disgrace of this surrender so weighed upon him that soon after returning to Carthage he committed suicide.

HIMILCO, or **HIMILCAR.** An early Carthaginian navigator of uncertain date, who explored the northwest coast of Europe, at the same time that Hanno explored the west coast of Africa. Avienus has preserved some fragments of the history of this voyage, in which mention is made of the Hiberni and Albioni, and of a promontory, Œstrymnis, thought to be Cornwall, and a group of islands, Œstrymnides, thought to be the Scilly Islands.

HIMMALEH, hĭm-mä'lē. See Himalaya.

HIM'MEL, Friedrich Heinrich (1765-1814). A German musician, born at Treuenbrietzen. Friedrich Wilhelm II. became his patron and enabled him to study music with Naumann at Dresden. On his return he was made royal chamber composer. In 1794 he went to Italy to continue his studies, producing there the operas *Il primo navigatore* (1794) and *Semiramide* (1795). In the latter year he returned to Germany and became Court kapellmeister in Berlin. In 1798 he went to Russia and brought out at Saint Petersburg his opera *Alessandro*. Subsequently he traveled much throughout Europe, settling finally in Berlin. Of his many popular operas the most successful was *Fanchon, das Leiermädchen* (1804), while of his songs, "An

Alexis" and "Es kann ja nicht immer so bleiben" were best liked. He also composed much Church and instrumental music.

HIM'YARITES. A name formerly used for a people of Southwestern Arabia, the Homerites of Ptolemy. According to tradition they came from a mythical ancestor, Himyar, who lived 3000 years before Mohammed. The more correct name of the people is Sabæan, from Saba, the capital of the district. See SABÆANS; MINÆANS.

HINCKLEY, hĭŋk'lĭ. A manufacturing and market town in Leicestershire, England, 13 miles southwest of Leicester (Map: England, E 4). Its chief buildings are the Gothic Church of Saint Mary, the Roman Catholic priory and Academy of Saint Peter, and a town hall. It has manufactures of cotton hosiery and boots. Hinckley stands on old Watling Street, the famous Roman road; it was created a barony soon after the Conquest, and had a castle and a Benedictine priory; its borough privileges were annulled by Edward IV. Population, in 1891, 9600; in 1901, 11,300.

HINCKLEY, THOMAS (1618-1706). Governor of Plymouth Colony from 1681, except during the administration of Sir Edmund Andros, until 1692, when Plymouth was united with Massachusetts. Of English birth, he came to the New England Colonies in 1635, and began to be active in the affairs of Plymouth in 1639, and was successively deputy, representative, and magistrate during 1645-80. In the latter year he was also Deputy Governor. Seven years before his appointment as Governor he held the office of commissioner on the central board of the Plymouth and Massachusetts Colonies, and continued in that position until the end of his governorship, and was afterwards a councilor. Governor Hinckley collected several volumes of papers which are now in the possession of the Boston Public Library.

HINCKS, EDWARD (1792-1866). An Irish Orientalist, son of Thomas Dix Hincks, the Presbyterian divine, and brother of Sir Francis Hincks, the Canadian statesman. Edward was born at Cork, and studied from 1807 to 1811 in Trinity College, Dublin. In 1825 he was appointed rector of Killyleagh, County Down, where, in spite of his seclusion, he undertook studies in hieroglyphics (1833), and wrote for the *Dublin University Magazine* and the *Journal of Sacred Literature*. Simultaneously with Rawlinson he discovered the syllabic character of the Assyrian cuneiform letters, and he had earlier written on the Egyptian hieroglyphics, and according to Brugsch was the first to decipher them correctly. He began an Assyrian grammar, but did not leave materials for its completion.

HINCKS, Sir FRANCIS (1807-85). A Canadian statesman, born at Cork. He went to Canada at the age of twenty-four, entered into business at Toronto, where he also edited the *Examiner* (1838), and became a leader among the Liberals, taking his seat in the first United Parliament in 1841. Three years afterwards, while his party was out of power, he directed the *Montreal Pilot*, and labored always for responsible government, and for the abolition of the clergy reserves and of the seigneurial system of landholding. When Hincks was made Premier of the Canadas in 1851, he negotiated a commercial treaty with the United States, and exerted himself to further the development of mines and railways; but got the country into debt, and, being accused by the Upper Canadian Protestants of favoring the Lower Canadian Roman Catholics, he gradually lost ground, and the Conservatives took the helm again in 1854. He was made Governor of Barbados (1855-62), and of British Guiana (1862-69), but afterwards returned to Canada, and was Minister of Finance until 1873, and edited afterwards the Montreal *Journal of Commerce*. He published: *Canada: Its Financial Position and Resources* (1849); *Reply to the Speech of Sir J. Howe on the Union of the North American Provinces* (1855); *Religious Endowments in Canada* (1869); *The Political History of Canada Between 1840 and 1855* (1877); and *The Boundaries Formerly in Dispute Between Great Britain and the United States* (1885).

HINC'MAR (806-82). A celebrated churchman of the ninth century. He was born in 806, presumably in Toulouse, as he belonged to the family of the counts of that province. He was educated in the Monastery of Saint-Denis, near Paris, and was intrusted with the framing and carrying out of a plan for the reformation of the monastery. In 845 he was elected Archbishop of Rheims. In this position he had to deal with the case of the alleged heretic Gottschalk (q.v.), whom he treated with great severity. In 862 he became involved in a controversy with Pope Nicholas I. Rothadius, Bishop of Soissons and suffragan of Hincmar, deposed a priest of his diocese, who appealed to Hincmar, as metropolitan, and was ordered by him to be restored to office. Rothadius, resisting this order, and having been, in consequence, condemned and excommunicated by the Archbishop, appealed to the Pope, who ordered Hincmar to restore Rothadius, or to appear at Rome, in person, or by his representative, to vindicate the sentence. Hincmar sent a legate to Rome, but refused to restore the deposed bishop; whereupon Nicholas annulled the sentence, and required that the cause should again be heard in Rome. Hincmar, after some demur, was forced to acquiesce. The cause of Rothadius was reëxamined, and he was acquitted, and restored to his see. Under the successor of Nicholas, Adrian II., a question arose as to the succession to the sovereignty of Lorraine on the death of King Lothaire, the Pope favoring the pretensions of the Emperor Louis II. in opposition to those of Charles the Bald of France. To the mandate which Adrian addressed to the subjects of Charles and to the nobles of Lorraine, accompanied by a menace of the censures of the Church, Hincmar offered a firm and persistent opposition. He was equally firm in resisting the undue extension of the royal prerogative in ecclesiastical affairs. Hincmar died at Epernay, whither he had fled from the Normans, December 21, 882. His works were collected by Sirmond (Paris, 1645), reprinted in Migne, *Patrol. Lat.*, cxxv.-cxxvi. Many others of his works are still in MSS. For his life, consult Schrörs (Freiburg, 1884).

HIND (AS., Icel. *hind*, OHG. *hinta*, Ger. *Hinde*, hind; probably connected with Goth. *hinþan*, to catch, related to AS. *huntian*, Eng. *hunt*, possibly connected with Gk. *κεμάς*, *kemas*, gazelle). The female of the red deer, a correlative of 'stag' or 'hart' (q.v.). In strict use, according to the ancient laws and customs of venery, it did not become the designation of a female red deer until the third year of its age. Latterly the word has become, outside of England, a synonym of doe.

HIND. A fish. See GROUPER.

HIND, HENRY YOULE (1823—). A Canadian geologist, born in England. He was educated at Leipzig and at Cambridge, and went to Canada in 1846. As geologist for the Dominion Government, he explored large areas in British America and Labrador, and made a geological survey of New Brunswick. He afterwards became a professor in King's College, Nova Scotia. In 1860 he was elected a fellow of the Royal Geographical Society. He is the author of *Northwest Territory,* and of numerous reports on explorations of the British possessions in North America.

HIND, JOHN RUSSELL (1823-95). An English astronomer, born at Nottingham. When a mere boy he devoted himself to astronomy, and at the age of seventeen he was given a position in the Royal Observatory at Greenwich. In 1844 he was appointed member of the commission sent to determine the exact longitude of Valentia. On his return he was appointed observer in Bishop's Observatory, Regent's Park, London. He calculated the orbits of a number of planets and comets, noted many new variable stars and nebulæ, and discovered ten new planetoids (q.v.), viz.: Iris and Flora in 1847; Victoria in 1850; Irene in 1851; Melpomene, Fortuna, Calliope, and Thalia, in 1852; Euterpe in 1853; and Urania in 1854. In 1851 Hind received from the Academy of Sciences in Paris the Lalande medal, and was elected a corresponding member. In 1852 he received the gold medal of the Astronomical Society of London, and obtained a pension of £200 a year from the British Government. He was superintendent of the *Nautical Almanac* in 1857-91. His scientific papers have generally been published in the *Transactions of the Astronomical Society,* the *Comptes Rendus* of Paris, and the *Astronomische Nachrichten.* His principal popular works are: *Astronomical Vocabulary* (1852); *The Comets* (1852); *The Solar System* (1846); and *Introduction to Astronomy* (1871). He was president of the Royal Astronomical Society in 1880.

HIND AND THE PANTHER, THE. A satirical poem by John Dryden (1687). It is a defense of the Roman Catholic Church in the form of an allegory, in which all characters are represented by animals. The Hind stands for the Roman, the Panther for the Anglican Church. Perhaps the most spirited satire is that on Burnet, represented by the Buzzard.

HINDENBURG, hĭn′d*e*n-bo͞ork, KARL FRIEDRICH (1741-1808). A German mathematician, born at Dresden. Educated at Leipzig, he became docent (1771) and professor (1781) in the university there. He edited the *Magazin für reine und angewandte Mathematik,* with Bernoulli (1786-89), and the *Archiv der reinen und angewandten Mathematik* (1794-99); but he is best known as the discoverer of combinatory analysis and as author of *Kombinatorisch-analytische Abhandlungen* (1796 and 1800).

HINDLEY, hĭnd′lĭ. A town in Lancashire, England, three miles southeast of Wigan (Map: England, D 3). Coal-mining and cotton manufactures are important industries. Its chief buildings are the free grammar school and the old parish church, which was desecrated by the Cavaliers during the Puritan Revolution. The municipality operates markets and remunerative gas and water works. Population, in 1891, 19,000; in 1901, 23,500.

HINDMAN, hĭnd′man, THOMAS CARMICHAEL (1818-68). A Confederate officer in the War of Secession. He was born in Tennessee; was educated in the common schools, studied law and removed to Mississippi to practice his profession. As a lieutenant in a Mississippi regiment he took part in the Mexican War, and was a Democratic member of Congress from 1858 to 1861. He was appointed to the command of a brigade in the Confederate Army soon after the Civil War began, and first served under Gen. Simon Buckner in Kentucky. At Memphis he was in command, and was afterwards defeated at the battles of Newtonia and Prairie Grove. Promoted to be a major-general at the battle of Shiloh, he was transferred to Arkansas. After the close of the war he went to the City of Mexico, but finally returned and settled in Arkansas in 1867. The following year General Hindman was murdered by one of his former soldiers in revenge for some disciplinary act during the war.

HINDOOSTAN, hĭn′do͞o-stăn′. See HINDUSTAN.

HINDU KUSH, hĭn′do͞o ko͞osh, or INDIAN CAUCASUS. A range of mountains, forming the westward continuation of the Himalaya, being sometimes reckoned a part of that colossal range (Map: Afghanistan, L 3). It extends from the Upper Indus on the east to the Bamian Pass (beyond which the continuing range is generally designated Safed-Koh) on the west, stretching in latitude between 34° and 36° N., and in longitude between 68° and 74° 30′ E., with a length of about 500 miles. Nearly the whole of it is contained in Afghanistan. The Oxus, or Amu-Darya, has its source in its northern ridges, and many tributaries of the Indus flow off from the south. For the first 100 miles west of the Pamirs, it is flat-topped, with passes ranging in altitude from 12,500 to 17,500 feet. Farther westward it becomes higher, and its plateau summit breaks up into peaks of which Tirach Mir, on the frontier of Chitral, is the loftiest, 25,400 feet in altitude. In this part are many passes over which trails or roads are in use. The range, which consists mainly of granites and schists, was probably uplifted in Tertiary time.

HINDU MUSIC. According to the ancient Hindu belief all arts were bestowed upon man by various gods, and music was the gift of Brahma. The early history of music in India is so beset with fables and reaches back to such remote antiquity that it is impossible to trace its real origin. We have, however, unmistakable evidence that several of the hymns of the *Rig-Veda* (about B.C. 1500) were intended to be sung to music. The hymns also mention flutes (*vāna*), cymbals (*karkari*), drums (*dundubhi*), and trumpets (*bakura*). Not only are the early accounts of the origin of music marked by an exuberance of the imagination, but the strictly scientific treatises on the subject of music are not free from this fault. The Hindu works on music are of uncertain date, but seem to be relatively late. Like much of Sanskrit literature, even when dealing with technical subjects, they are written in verse. They exist for the most part as yet only in manuscript. The most important are the *Saṁgītadarpaṇa* of Damodara, the Saṁgīta*nārāyaṇa* by Narayana, the *Saṁgītaratnākara* of Śarngadeva (edited by Telang, Poona, 1897), the *Rāgavibōdha* of Somanatha (edited by Gharpure, Poona, 1895), the *Rāgamāta* of Kshemakara and many others of less value.

The oldest scale of the Hindus, the *Vēlāvali*, consists of only five tones, F, G, A, C, D, and is identical with that of the Chinese. In the course of time two tones were added, and A was taken as the starting-point. Thus a scale identical with our A major was obtained. A scale was known as *Svaragrāma* or *Saptaka*, and the different tones were designated by the syllables *Sa*, *Ri*, *Ga*, *Ma*, *Pa*, *Dhai*, *Ni*. Each of these syllables denoted not only the fundamental tone, but was applied equally to all its chromatic alterations. Within any scale three tones were designated by special names. These were the first, third, and fifth, known as *Ansa*, *Graha*, and *Nyāsa* respectively. Their function is stated in the *Saṁgītanārāyaṇa:* "The note Graha stands at the beginning and Nyasa at the end of a song. Ansa is the leading note; it gives to the melody its particular character and is used the most frequently, and the other notes are subordinated to it as to a ruler." The seven tones of the scale were repeated three times in succession, and thus a compass of three *Aṣṭan* or octaves was obtained. The different tones were classified as major tones, minor tones, and semitones. Each major tone consisted of four quarter tones, each minor of three quarters, and each semitone of two quarters. These subdivisions were called *śrutis*, of which each octave had 22. Major tones were the first, fourth, and fifth, minor tones the second and sixth, semitones the third and seventh. The *Rāgavibōdha* admits the possibility of no less than 960 modes, but enumerates only 36. Even out of these only 23 are recognized as having practical value. These 36 modes were divided into 6 primary called *Rāgas*, and 30 secondary modes called *Rāgiṇis*. The number of Ragas was determined by the number of seasons, which in India is six. An attempt was made to have each Raga express, as closely as possible, the character of the season to which it corresponded. It also was improper to play a Raga at any other season than the one of which it was the expression. Musical notation by means of a staff was unknown to the Hindus. The different tones were represented by their initial consonants with lines drawn above or below to indicate to which *Aṣṭan* or octave the particular tone belonged. Embellishments and marks of expression were represented quite definitely by means of small circles, ellipses, chains, curves, horizontal and perpendicular lines. The end of a phrase was indicated by a lotus-flower.

Of the musical instruments the *Viṇa* (q.v.) was the principal one, and is still used to-day in India. The *Magoudi* was also a stringed instrument with four strings. Among the varied instruments the principal ones were the *Basarće*, a flute with seven holes, and the *śankha*, a kind of trumpet made from a sea-shell. From the perfection of the Vina it can easily be inferred that India was far in advance in the art of music over all other Asiatic countries of antiquity. In spite of the complicated theoretical system, composers employed chiefly the *śrīrāga*, our modern A major. The minor mode occurs also, but very seldom. In the religious cult of the Hindus music was of primary importance. Music, both vocal and instrumental, was strictly regulated by laws. The former was called *Gaṇa*, the latter *Vādya*. Pantomimes were known as *Nṛtya;* and a combination of all was designated by the term *Sangīta*. Consult: Jones, "On the Musical Modes of the Hindus," in *Asiatick Researches*, vol. iii. (Calcutta, 1792), reprinted in his *Works*, vol. iv. (London, 1807); Paterson, "On the Grâmas or Musical Scales of the Hindus," ib., vol. ix. (ib., 1807); Bird, *The Original Miscellany, Being a Collection of the Most Favorite Airs of Hindostan* (Calcutta, 1789); Tagore, *Hindu Music from Various Authors* (ib., 1875); Schröder, *Indiens Litteratur und Cultur* (Leipzig, 1887); Day, *The Music and Musical Instruments of Southern India and the Deccan* (London, 1891).

What strikes a student of the original Hindu melodies is the great discrepancy between musical theory and actual practice. Evidently the composers disregarded theoretical speculations and wrote according to the dictates of their ear; for all the melodies are found to be written exactly in our major or minor modes, and can be harmonized accordingly without the least difficulty.

HINDUSTAN, hĭn'dōō-stăn', or **HINDOOSTAN**. The land of the Hindus. A portion of India situated north of the Vindhya Mountains in the valley of the Upper Ganges. The name has been used loosely as a designation of the Indian Peninsula. See INDIA.

HINDUSTANI (hĭn'dōō-stä'nê) **LANGUAGE AND LITERATURE**. The *lingua franca* of Northern India. This is in structure an Indian language, descended from a sister dialect of the ancient Sanskrit through mediæval Prakrit vernaculars, Hindustani is divided into nearly sixty subdialects, which in the eastern portion of its district are approximate Bengali, and in the south and west closely resemble Marathi and Gujarati. The territory of Hindustani, which is the vernacular of nearly 100,000,000 people, covers some 248,000 square miles. The standard dialect is the Brāj Bhāsha, spoken in the districts of Delhi, Agra, and Mathura. Hindustani abounds in Turkish, Arabic, and Persian words, as well as in numerous borrowings from Dravidian and Kolarian dialects. In this form it is called Urdu, which in Turkish signifies 'camp.' This term is a relic of the Mohammedan invasions of the country around Delhi in the twelfth century, when conquerors and conquered sought to find a speech which they might each understand. During the nineteenth century the vocabulary of the language was purified to a great extent of the foreign element, and the usage of native words as far as possible has since been preferred. Hindustani without these non-Indian importations is called Hindi or High Hindi.

In structure the language is analytic. In this it resembles the other modern Indian languages, as well as Persian, and in many respects English. It forms cases, tenses, etc., by postpositions, periphrases, and the like. Thus from *ghar*, 'house' (Sanskrit *grha*), is formed the genitive *ghar kā*, ablative *ghar sē*, instrumental *ghar nē*, while the plural of the same cases is *gharōn kā*, *gharōn sē*, *gharōn nē*. There are two genders, two numbers, two voices, and nine tenses in common use, e.g. *main dekhtā* 'I see,' *main dekhtā hūn* 'I am seeing,' *main dekhūngā* 'I am going to see,' *main nē* *dekhā hai* 'I have seen' (lit. 'by me it has been seen'), and so forth. Hindi is written in the Devanagari alphabet, like Sanskrit and Marathi, while Urdu employs the Perso-Arabic script with three additional characters to represent specifically Indian sounds.

Hindustani literature is very abundant, although for the most part it rises little above mediocrity in character. It begins with the *Prithvirāj Rāsau*, by Chand Bardai (about A.D. 1200), who related in his long poem the history of Prithviraja II., the last Hindu King of Delhi. Much of the literature consists of translations from the Sanskrit, as well as from Persian and Arabic. The most noteworthy specimens of this particular class of work are the *Rāmāyan* of Tulsdas, begun A.D. 1575, and the *Bagh u Bahār*, "Garden and Spring," which Amman of Delhi translated from the Persian collection of stories called the "History of the Four Dervishes" at the beginning of the nineteenth century. History and the drama also find their place in this literature, which is the most important in modern India.

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HINGE (ME. *henge*, from *hengen*, secondary form of *hangen*, to hang). The pivots or joints on which doors, shutters, etc., revolve. The simplest form of hinge is a projection cut upon the substance of which the door is made and fitted into a hole. This is sometimes done with wooden shutters, and there are examples extant of stone shutters hinged in this manner. The cathedral of Torcello, near Venice, which dates from the eleventh century, still has the windows protected with shutters formed of large slabs of stone, hinged on stone pivots. During the Middle Ages hinges, as well as every other useful article, were made subjects of ornamentation. The earliest ornamental hinges date from about the tenth century. The first examples are cramped and stiff, and the scrolls are frequently terminated with animals' heads. In the Early English and Decorated styles, the hinges and other metal-work were very elaborate and beautiful in design, and frequently extended over the whole of the doors. In the Perpendicular style, hinges were usually very simple in form, the paneling of the woodwork not admitting of much ornamental ironwork. In modern times hinges are chiefly made of brass and iron, and unless intended for decorative effect are fitted on the edges of the doors and shutters, where they are concealed. The revival of mediæval architecture has given an impulse to the manufacture of ornamental metal-work, and hinges of varied and good design are produced.

HINGHAM, hĭng'*am*. A town in Plymouth County, Mass., comprising the villages of West Hingham, South Hingham, and Hingham Centre; 17 miles southeast of Boston; on Massachusetts Bay, and on the New York, New Haven and Hartford Railroad (Map: Massachusetts, F 3). It has Derby Academy, a public library, and an old meeting-house which dates from 1681. The government is administered by town meetings. Population, in 1890, 4564; in 1900, 5059. Hingham was settled in 1633, and was known as Barecove until 1635, when it was incorporated under its present name. It was the home of Gen. Benjamin Lincoln, John A. Andrew, and John D. Long, and the birthplace of James Hall, the eminent geologist. Consult Lincoln (and others), *History of the Town of Hingham* (Cambridge, 1893).

HINK'SON, Mrs. KATHARINE (maiden name TYNAN), (1861—). An English novelist and verse-writer, born in Dublin, Ireland. She was educated at the Dominican Convent of Saint Catherine of Sienna at Drogheda, Ireland. In 1893 she married H. A. Hinkson, and took up her residence in London. She is favorably known for her verse contained in *Louise de la Vallière and Other Poems* (1885); *Shamrocks* (1887); *Cuckoo Songs* (1894); *Ballads and Lyrics* (1897); *The Wind in the Trees* (1898); and *Collected Poems* (1901). She also portrayed phases of Irish character in a series of pleasant novels, comprising chiefly: *A Cluster of Nuts*, short tales (1894); *The Way of a Maid* (1895); *O, What a Plague is Love* (1896); *The Handsome Brandons* (1898); *The Dear Irish Girl* and *She Walks in Beauty* (1899); *Three Fair Maids* and *A Daughter of the Fields* (1900); *A Girl of Galway* (1901); *The Handsome Quaker* (1902); *A King's Woman* (1902). For an appreciative estimate of Mrs. Hinkson as a poet, consult William Archer, *Poets of the Younger Generation* (New York, 1902).

HINLICHE, ên-lĕ'châ, 'Southern People.' A pastoral tribe of Araucania, wandering over the southern pampas of Argentina. They live in portable tents of skins and subsist entirely upon meat derived from their herds of horses, cattle, and sheep. They are skillful artificers in leather and iron, while the women make rugs of ostrich-skins and weave woolen blankets and ponchos of superior quality.

HINNOM, VALLEY OF. A ravine in or near Jerusalem. The precise location has not yet been determined. Scholars differ as to which of the three valleys, Kidron, Tyropœon, or Wady er-Rababi, is likely to have been called the Valley of Hinnom. Jewish and Arab tradition favor the first, which runs east of the temple elevation. A majority of recent investigators prefer the last, which is south of the present city. Much probability, however, seems to attach to the Tyropœon. In Enoch xxvi., the ravine over which the author marvels is evidently the Valley of Hinnom, and it is unquestionably identical with the Tyropœon, lying between Mount Zion and the western hill. Consequently a writer familiar with Jerusalem and living toward the end of the second century B.C. located the Valley of Hinnom in the Tyropœon. The chief objections are that if the city did not in preëxilic times extend beyond the Tyropœon, there ought to be some remains of walls there, and that, if the Tyropœon was within the city, the sacrifices of the firstborn to Moloch would have been made in the immediate neighborhood of the Yahweh temple. But whatever the extent of the city, it is highly improbable that important sanctuaries were left unprotected outside the walls. That Solomon should build temples to Chemosh and Moloch, the gods of the conquered Moabitish and Ammonitish dependencies, was only natural (I. Kings xi. 7). These shrines would not be far from the royal sanctuary. When even kings like Ahaz and Manasseh offered their firstborn, and questions such as those in Micah vi. 6-7 could be asked in Judah touching the expediency of making similar sacrifices to Yahweh, there is no reason to suppose that the inhabitants of Jerusalem objected to having offerings of the firstborn made to Moloch near the Yahweh temple. A later addition to I. Kings xi. 7, found in the Greek version, states that Solomon also built a temple to Ashtaroth. (See ASTARTE.) This is not improbable, but it may simply reflect the memory of the actual existence of such a sanctuary in the valley. The sites had probably been occupied long before Solomon by Canaanitish shrines. The name of the valley is quite obscure. Its full title seems to have been either "Valley of the Sons of Hinnom" or "Valley of the Son of Hinnom." The former is found in II. Kings xxiii. 10, and often in the best manuscripts of the Greek version; the latter in Joshua xv. 8 and xviii. 16, where the abbreviated form Valley of Hinnom is also found, and in II. Chron. xxviii. 3, xxxiii. 6; Jer. vii. 31-32, xix. 2-6, xxxiii. 35. Hinnom was regarded by the Greek translators as a proper name, and many modern authors take the same view. But as the name is changed in Jer. vii. 32, xix. 6, to 'Valley of Slaughter,' it probably originally suggested a pleasant meaning. It has been conjectured that the name of the divinity worshiped in the valley was *Ben Naaman*, 'pleasant son,' which may have been a descriptive title of Tammuz. Another explanation, necessitating no alteration of the consonantal text, is that *hinam* meant in this connection 'sexual enjoyment,' and that the participants in the licentious rites practiced at the shrines and in the groves of this valley were called 'sons of joy.' In the Babylonian Talmud (*Erubin*, 19 a), Hinnom is connected with the word *hinam* used in the sense of levity, licentiousness. The meaning of the root is 'to be jocund,' and the word *hinnom* should probably be connected with it. At one of the sanctuaries in this valley children were passed through the altar-fire to Moloch. It is not evident whether the phrase implies a burnt-offering or an ordeal by fire. But Josiah defiled one of the chief sanctuaries, the Taphet, later pronounced Tophet to suggest *bosheth*, 'shame.' What basis there is for the mediæval rabbinic statement that perpetual fires were kept up in this valley for consuming dead bodies of criminals and carcasses of animals, cannot be ascertained. If Tophet was at the southern end of the Tyropœon, near Siloam, this cremation of refuse would be outside the city limits. The apocalyptic expectation in the second century of a final battle between the nations and Israel outside of the holy city seems to have rested upon this feature of the surroundings. Here the enemy would be consumed, and the pious who should go up to the temple in Jerusalem on Sabbaths and at new moons would look with satisfaction upon the carcasses consumed by fire and worms (Is. lxvi. 23-24). The same idea is found in Enoch xxvii. Gradually the term *Ge Hinnom*, or Aramaized, *Gehenna*, came to be used, not of this valley in Jerusalem, but of the subterranean Tartarus to which it was the entrance; of the unseen place of final punishment of the impenitent; of the sudden destruction of both soul and body; or figuratively, of the inner condemnation of spiritual loss. On the geographical question, consult: Warren's article "Hinnom," in the Hastings *Bible Dictionary;* Conder's article "Jerusalem," in the *Encyclopædia Biblica;* George Adam Smith, *Historical Geography of the Holy Land* (London, 1897). See GEHENNA; HELL; JUDGMENT, FINAL; ESCHATOLOGY.

HINNY (Lat. *hinna*, *hinnus*, Gk. *ἴννος*, or *ginnus*, Gk. *γίννος*, mule from a stallion and a she-ass). The hybrid produced between a horse and a female ass. It is smaller than a mule, but the body is more bulky in proportion to the legs, and its strength is inferior. It is less valuable than the mule, although more docile. The hinny is rare. It was described by some of the earlier naturalists as a hybrid between the ox and the ass.

HINOYOSSA, hĕ'noi-ŏs'sȧ, ALEXANDER D'. The director of Nieuer Amstel, a Dutch colony established on the east bank of the Delaware in 1656, and afterwards Governor of all the settlements on that river until the conquest of New Netherland by the English. Hinoyossa was born and died in Holland, and his activity in the Dutch settlements of America extended from 1656 to 1674. He came to New Amsterdam in 1656 as lieutenant in a small force of soldiers accompanying 150 Dutch emigrants, and succeeded Jacob Aldrichs as director of Nieuer Amstel in 1659. His position was a trying one on account of the conflicts of authority which were continually disturbing the colony, especially in regard to taxation. Appeals to Holland were frequent, and Hinoyossa refused to recognize the authority of Director Stuyvesant, of New Amsterdam, who had the supervision of the commissioners composing the government of the colony. As an investment the latter was not at first profitable, owing to sickness and dissension among its members; but Hinoyossa governed so vigorously and wisely that all attempts by the West India Company to secure control failed. Confident of his own ability and seeing the necessity of a single and undisputed authority, Hinoyossa went to Holland in 1663 to ask for the entire direction of all the Delaware settlements, which was finally given to him. Director Stuyvesant formally transferred his authority, and the Swedes, who had rival settlements there, after a fruitless effort to resist the change also became obedient, and accepted Hinoyossa's control. On the English conquest of New Netherland Hinoyossa returned to Holland and became a soldier in the Republican Army in the great war with Louis XIV.

HINSDALE, hĭnz'dȧl, BURKE AARON (1837-1900). An American educator. He was born in Ohio, and was educated at Hiram College, where he was a pupil of James A. Garfield. In 1861 he entered the Campbellite ministry, preaching in Cleveland and other places, and in 1866 was chosen assistant editor of the *Christian Standard.* Three years later he became professor of history and English literature in Hiram College, and from 1870 to 1882 was its president. After a few years' service as superintendent of schools at Cleveland, Ohio, he was appointed professor of the science and art of teaching in the University of Michigan in 1886. Among his publications are: *Genuineness and Authenticity of the Gospels* (1870); *Jewish Christian Church* (1878); *Ecclesiastical Traditions* (1879); *The Republican Text-Book* (1880); *Garfield and Education* (1881); *The Old Northwest* (1888); *How to Study and Teach History* (1894); *Teaching the Language Arts* (1896); and *Horace Mann and the Common-School Revival in the United States* (1898). He also edited the *Life and Works of James A. Garfield* (2 vols., 1882-83).

HINTERLAND, hĭn'tẽr-länt (Ger., back territory). A term that came into general use at the time of the partition of East Africa between Germany and England in 1890. The doctrine of the hinterland is the claim of German diplomats that when a power takes possession of a strip of seacoast, its rights extend inland indefinitely, or until its territory reaches the recognized boundary of some other power.

HIN'TON. A city and the county-seat of Summers County, W. Va., 100 miles southeast of Charleston; on the New River, and on the Chesapeake and Ohio Railroad (Map: West Virginia, D 4). It is a railroad division headquarters with repair-shops, etc., and has also sawmills and other industrial establishments. Population, in 1890, 2570; in 1900, 3763.

HINTON, JAMES (1822-75). An English aurist and metaphysician, born at Reading. He received his education at the Hospital of Saint Bartholomew, and began to practice in London about 1850 as an ear specialist. Besides lecturing upon his chosen subject in Guy's Hospital, from 1862 to 1874, he published: *Man and His Dwelling-Place* (1859); *Life in Nature* (1862); and *The Mystery of Pain* (1865). Two of his books upon similar subjects were issued posthumously. Ellice Hopkins edited his *Life and Letters* (1878).

HINZPETER, hĭnts'pā'tẽr, GEORG ERNST (1827—). A German educator, born at Bielefeld, where he taught after his university course at Halle and Berlin. The Crown Prince's tutor, Hinzpeter became a privy councilor and member of several governmental boards after Wilhelm II. came to the throne, strongly influenced the Emperor's educational policy, and in 1890 was prominent in the Berlin Conference on Higher Education. He wrote *Kaiser Wilhelm II.* (9th ed. 1889).

HIOGO, hyō̆'gō̂, or **FIOGO.** A part of the Japanese town of Kobé (q.v.).

HIONG-NU, hyŏng'nōō'. By this name the Chinese chroniclers designate a people of Turkish or Tatar race who, some two centuries B.C., founded a powerful kingdom in Central Asia, conquered Turkestan, and made inroads into China. The kingdom of the Hiong-Nu lasted until the middle of the first century A.D., when it split into two sections, of which the northern soon disappeared from history. Some identify the Huns with the Hiong-Nu. The Chinese account of this people was published (in translation) in the *Journal of the Anthropological Institute* (London) for 1874. Many ethnologists see in the Hiong-Nu the ancestors of the Turks.

HIOUEN-THSANG, hê-wĕn-tsäng'. A celebrated Chinese Buddhist traveler, who visited 110 places of India in the first half of the seventh century (629-645), and gave an account of the condition of Buddhism at that period in India. His interests being chiefly religious, he did not enter much into details concerning the social and political condition of India. His narrative, however, gives many curious facts which he observed, and, possessing a high degree of trustworthiness, is one of the most important documents for the history of India at that time. Apparently he traveled alone, or with a few occasional companions, and wore the garb of a religious mendicant. It does not appear that the account of his travels was written by himself. The first of the two works relating to them is a biographical notice of him, in which his travels form a principal feature; it was composed by two of his pupils, Hoei-li and Yen-Thsong. The latter bears the title of *Ta-thang-si-yu-ki*, or "Memoirs of the Countries of the West, published under the Thang," and was edited by Pien-ki. Both works have been published in a French translation by the Chinese scholar M. Stanislaus Julien in his *Histoire de la vie de Hiuen-Thsang* (1853), and his *Mémoires sur les contrées occidentales, par Hiuen-Thsang* (1857-58). For his biography, consult Beal, *Life of Hiuen-Tsaing* (London, 1888).

HIP-JOINT. A ball-and-socket joint, formed by the reception of the globular head of the thigh-bone (or femur) into the deep pit or cup in the *os innominatum*, which is known as the *acetabulum* (so called from its resemblance to the vinegar cups used by the Romans). If the variety of the movements of this joint—viz., flexion, extension, abduction, adduction, and rotation inward and outward—and at the same time its great strength are considered, it may well claim to be regarded as the most perfect joint in the whole body.

The ligaments are usually described as five in number: (1) The capsular; (2) the ilio-femoral; (3) the teres or round; (4) the cotyloid; and (5) the transverse. The capsular ligament extends from the edge of the cup to the circumference of the neck upon which the ball is carried, inclosing the bony parts in a strong sheath. The ilio-femoral, or Y-ligament, is merely an accessory band of fibres which give increased thickness to the capsular ligament in front, where strength is specially required. The great use of the capsular ligament is to limit the extension of the hip-joint, and thus to give steadiness to the erect posture. The only other ligament requiring notice is the teres, or round ligament, which is in reality triangular rather than round, and has its apex attached to the head of the thigh-bone, while its base is connected with the cavity of the acetabulum. Its use is not very clearly known, but probably is to support and protect vessels giving blood-supply to the head of the bone. It is sometimes absent in cases in which no special weakness of the joint was observed during life, and is of by no means constant occurrence in mammals. The joint is much strengthened by a large number of surrounding muscles, some of which are of considerable power.

In such a joint as this, although the ligaments materially assist in preventing dislocation, it is obvious that the articular surfaces cannot, under ordinary circumstances, be kept in apposition by them, inasmuch as they must be loose in their whole circumference, to permit of the general movements of the joint. The experiments of Weber have shown that atmospheric pressure is the real power by which the head of the femur is retained in the acetabulum when the muscles are at rest.

Disease of the Hip-Joint. Hip-disease differs in so many points of importance from other joint-diseases, and is so serious an affection that it requires a special notice. Its connection with the scrofulous or strumous diathesis is more distinctly marked than that of most other joint-diseases, and it almost always occurs before the age of puberty. It is essentially a tubercular inflammation of the hip-joint. Its beginning may be often associated with some trivial occurrence, such as over-exertion in a long walk, a sprain in jumping, or a fall.

In the early stage of the disease, the whole of the structures of the joint are inflamed, and by proper treatment at this period the morbid action may be sometimes subdued without any worse consequences than a more or less rigid joint. Usually, however, abscesses form around the joint, and often communicate with its interior; and the acetabulum, and the head and neck of the thigh-bone, become disintegrated, softened, and roughened. In a still more advanced stage, dislocation of the head of the thigh-bone commonly occurs, either from the capsular ligaments becoming more or less destroyed, and the head of the bone being drawn out of its cavity by the action of the surrounding muscles, or from a fungous mass sprouting up from the bottom of the cavity, and pushing the head of the bone before it. It is of extreme importance that the symptoms should be detected in an early stage of the disease, and surgical aid at once be sought.

As the disease advances, abscesses, as already mentioned, occur around the joint, which sometimes, from the tension they exert on the obturator nerve, occasion extreme pain in the inside of the thigh. True shortening of the limb now takes place, which at the same time becomes adducted and inverted. From this stage, if the general health is good, the patient may be so fortunate as to recover with an anchylosed (or immovable) hip-joint; but occasionally a condition of exhaustion comes on, the tubercular process exhibits itself in the lungs and elsewhere, and death finally supervenes from the prolonged septic processes. The duration of the disease may vary from two or three months to ten or more years. The essential factor in the treatment of these cases is complete immobilization of the joint for a protracted period by means of plaster splints or rigid metal braces. With this must be combined nourishing food, fresh air, and sunlight, with general exercise of the body as early as is practicable.

HIPPARCHUS, hĭp-pär′kŭs (Lat., from Gk. Ἵππαρχος) (fl. between B.C. 161 and 126). A Greek astronomer and mathematician. He was born in Nicæa, Bithynia, but his astronomical work was done on the island of Rhodes, and possibly also in Alexandria. Of his personal history nothing is known. He was the founder of genuinely scientific astronomy, and also of a part of that science which lies on the border-land of astronomy and geometry, viz. trigonometry. In this field he computed a table of chords, which, although lost, is known to us through the works of Theon of Alexandria (q.v.), who wrote about A.D. 365. It is probable, too, that this is the Hipparchus who wrote on combinatory analysis, and that the Arabs were correct in attributing to him a knowledge of the quadratic equation. Certain it is that Ptolemy was indebted to him for much of the *Almagest* (q.v.). According to Fabricius, Hipparchus wrote nine separate works; but of these only the *Commentary on Aratus* has come down to us. From the *Almagest* we learn that it was Hipparchus who first discovered the precession of the equinoxes, determined the place of the equinox among the stars, invented solar and lunar theories, invented the astrolabe (q.v.), and drew up a catalogue of upward of 1000 stars, determining the longitude and latitude of each (this catalogue has been preserved in the *Almagest*). As Ptolemy was also an astronomer, there is some difficulty in allotting to each his meed of praise for the discoveries mentioned in the *Almagest*, which difficulty has given rise to some discussion. Consult: Delambre, *Histoire de l'astronomie ancienne* (Paris, 1817); Berger, *Die geographischen Fragmente des Hipparch* (Leipzig, 1870); Wolf, *Geschichte der Astronomie* (Munich, 1877).

HIPPARCHUS (c.555-514 B.C.). The son and one of the successors of Pisistratus, tyrant of Athens. On the death of Pisistratus (B.C. 527), Hipparchus and his older brother, Hippias, kept the government of Athens in their hands. Hipparchus interested himself in art and literature, as his father had done. He was murdered by Harmodius and Aristogiton in 514, at the Panathenæa, probably in revenge for a personal insult, though the Greeks of the next century commonly considered the murderers as patriots and saviors of their country.

HIPPA′RION (Neo-Lat., from Gk. ἱππάριον, pony, diminutive of ἵππος, *hippos*, horse). A fossil horse, somewhat smaller than the Asiatic ass, remains of which have been found in Upper Miocene rocks of North America and in the Pliocene deposits of North Africa, Asia, and Europe.

HIP′PEL, Theodor Gottlieb von (1741-96). A German humorist and satirist, born at Königsberg. After traveling in Russia, he settled in his birthplace as tutor and student of law, and in 1786 became Privy Councilor of War and president of the town. He published: *Ueber die Ehe* (1774, edited by Brenning, 1872); *Ueber die bürgerliche Verbesserung der Weiber* (1792); *Lebensläufe nach aufsteigender Linie, nebst Beilagen A. B. C.* (1778-81, edited by Ottingen, 1883); and *Ueber weibliche Bildung* (1801). In these works he attempted to express and popularize the philosophy of Kant's *Kritik*, then unpublished. Of a more satiric and political nature are: *Zimmermann I. und Friedrich II., von Johann Heinrich Friedrich Quittenbaum Bildschnitzer in Hannover* (1790), and *Kreuz und Querzüge des Ritters A. bis Z.* His other works include some hymns: the idyllic *Handzeichnungen nach der Natur* (1790); the drama *Der Mann nach der Uhr* (2d ed. 1771); and *Ueber das Königsberger Stapelrecht* (1791). His collected works were published at Berlin in fourteen volumes (1827-38). Consult his autobiography (Gotha, 1801).

HIP′PIAS (Lat., from Gk. Ἱππίας) (?-c.490 B.C.). A tyrant of Athens, son of Pisistratus, upon whose death (B.C. 527) he assumed the government in conjunction with his brother Hipparchus. According to Thucydides, the government of the brothers was conducted on the same principle as that of their father, and many distinguished poets, including Simonides of Ceos and Anacreon of Teos, lived at Athens under their patronage. After the assassination of Hipparchus, in B.C. 514, Hippias seized the reins of government alone, and avenged the death of his brother by imposing extraordinary taxes, selling offices, and putting to death all of whom he entertained the least suspicion. At length, however, his despotism was overthrown. The Delphic oracle was bribed to enjoin the Lacedæmonians to free Athens from the Pisistratidæ, and after one or two unsuccessful attempts the tyrant's old enemies, the Alcmæonidæ, to whom Megacles belonged, supported by a Spartan force under Cleomenes, defeated Hippias in the field, captured his children, and compelled him and all his relatives to leave Attica (B.C. 510). As soon as they had departed, a decree was passed condemning the tyrant and his family to perpetual banishment, and a monument commemorative of their crimes and oppression was erected in the Acropolis. After spending some time at Sigeum, Hippias went to the Court of Darius, and incited the first war of the Persians against the European Greeks. He accompanied the expedition sent under Datis and Artaphernes, and persuaded the Persians to land at Marathon. It cannot be determined whether he was killed during the battle or whether he died at Lemnos on his return.

HIPPIAS OF E'LIS (c.460 B.C.-?). A Greek mathematician, writer, diplomat, and philosopher. He was a teacher of renown, a man of great pretense, but a scholar of little originality. His teaching, for which his pupils were compelled to pay heavily, was directed to the practical end of success in a worldly way, to display, and to ability in public address. It is probable that he is the Hippias mentioned by Proclus (on the authority of Geminus) as the inventor of the quadratrix, a curve originally designed, it is thought, for dividing an arc in a given ratio, but which also lends itself readily to the quadrature of the circle. (See QUADRATURE.) This curve, however, usually bears the name of Dinostratus, since he studied it with so much care.

HIPPID'IUM. An extinct ancestor of the horse. See HORSE, FOSSIL.

HIP'PO (Lat., from Gk. Ἱππών, *Hippōn*), or HIPPO REGIUS. A Phœnician colony in North Africa, later a favorite residence of Masinissa, King of Numidia, of which the scanty ruins are yet to be seen, near Bona, Algeria. Hippo was a flourishing trading city under the Roman rule, and in later years the see of Saint Augustine, who died here in A.D. 430, just before the destruction of the city by the Vandals.

HIP'POBOS'CIDÆ (Neo-Lat. nom. pl., from Gk. ἱπποβοσκός, *hippoboskos*, feeding horses, feeding on horses, from ἵππος, *hippos*, horse + βόσκειν, *boskein*, to feed). A strange and important family of dipterous insects which are parasitic upon birds and mammals, and which are popularly known by the name of 'bird-ticks.' This is misleading, since they are not ticks, and are not confined to birds, although the adults live and move quickly about among the feathers and hair of birds and mammals. Unlike most other external parasites of the higher animals, many of them possess wings, although they are otherwise modified as the result of their parasitic life. Their development is very abnormal, and differs from that of all other insects. The eggs hatch and the larvæ develop within the mother, and are extruded only when ready to transform to pupæ. *Hippobosca equina* is a winged species which occurs on the horse, and is known in England as the 'forest fly.' *Melophagus ovinus* is a wingless form, and occurs on the sheep. One of the commonest of the North American species is *Olfersia Americana*, which is found upon certain birds, like the horned owl, certain hawks, and the ruffed grouse. The species of the genus Lipoptena may, while still winged, live on birds, but afterwards they lose their wings, and are then found on mammals.

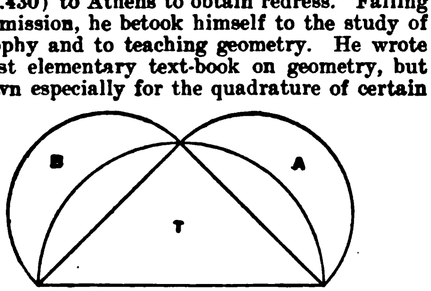
HIP'POCAM'PUS. See SEA-HORSE.

HIP'POCRAS (from Fr. *hippocras, hypocras*, from Lat. *Hippocrates*, Gk. Ἱπποκράτης, *Hippokratēs*, a famous Greek physician). An aromatic medicated cordial, formerly much used in Great Britain. It was made of spiced wine, mixed with sugar, lemon, aromatic tincture, or other ingredients.

HIPPOC'RATES (Lat., from Gk. Ἱπποκράτης, *Hippokratēs*) (c.460-357 B.C.). A Greek physician, the most celebrated of antiquity, and justly called 'the father of medicine.' He was the son of Heraclides, also a physician, and belonged to the family of the Asclepiadæ, being either the nineteenth or seventeenth in descent from Æsculapius. His mother, Phænarete, was said to be descended from Hercules. He was born in the island of Cos. He is said to have been instructed in medicine by his father and by Herodicus, and in philosophy by Georgias of Leontini, the sophist, and Democritus of Abdera, whom he afterwards cured of insanity. After spending some time in traveling through different parts of Greece, he settled and practiced his profession at Cos, and finally died at Larissa, in Thessaly. He is said to have passed the age of a hundred. We know little more of his personal history than that he was highly esteemed as a physician and an author, and that he raised the medical school of Cos to a very high reputation. His works were studied and quoted by Plato. Various stories are recorded of him by Greek writers, which are undoubtedly fabulous; and legends regarding him are found in the works of Arabic writers, who term him Bukrat, while the European story-tellers of the Middle Ages celebrate him under the name of Ypocras. The works bearing the name of Hippocrates, and termed the Hippocratic collection, are 72 in number, and include many treatises by his sons, Thessalus and Draco, by his son-in-law, Polybus, and by others. The following are considered authentic: *Epidemics; Regimen in Acute Diseases on Air, Water, and Places; On Wounds of the Head;* parts of the *Aphorisms;* and parts of the *Prognostics;* the work on *Ancient Medicines; Joints; Fractures; The Use of the Lever; Law; Ulcers; Hæmorrhoids; The Sacred Disease; Fistulæ;* and *On the Duty of the Physician*, as well as the *Oath.* Hippocrates divides the causes of disease into two principal classes—the first consisting of the influence of seasons, climates, water, situation, etc., and the second of more personal causes, such as the food and exercise of the individual patient. His belief in the influence which different climates exert on the human constitution is very strongly expressed. He ascribes to this influence both the conformation of the body and the disposition of the mind, and hence accounts for the difference between the Greek and the Asiatic. The four fluids or humors of the body (blood, phlegm, yellow bile, and black bile) were regarded by him as the primary seats of disease; health was the result of the due combination (or crasis) of these, and illness was the consequence of a disturbance of this crasis. When a disease was proceeding favorably, these humors underwent a certain change (or *coction*), which was the sign of returning health, as preparing the way for the expulsion of morbid matter, or *crisis*, these crises having a tendency to occur at definite periods, which were hence called 'critical days.' His treatment of diseases was cautious, and what we now term expectant; it consisted chiefly and solely in attention to diet and regimen. Thus he was the inventor of the humoral pathology, so long in vogue in medical schools. He must be judged by the standards of his day. A most careful and keen observer and exact chronicler of symptoms, he was also possessor of a remarkable mental equipment and a man of great nobility and morality.

The works of Hippocrates were translated at an early period into Arabic. They were first printed in a Latin translation in 1525 at Rome, Galen's commentaries on his works being of special value. The first Greek edition (the Aldine) appeared the following year at Venice; an edition by Mercurialis appeared in 1588, one by Foesius in 1595, and one by Van der Linden (still much esteemed) in 1665. An edition under the editorship of Kuhn appeared in three volumes at Leipzig, in 1825-27. The best French edition is that of Littré, in 10 volumes, the first of which appeared in 1839, and the last in 1861. An excellent English translation of *The Genuine Works of Hippocrates* was published in 1849 in 2 vols. by Dr. Adams.

HIPPOCRATES OF CHIOS, kī'ŏs (c.450 B.C.). A Greek geometer, possibly related to the family of the celebrated physician. His early life was devoted to maritime commerce, and the seizure of a vessel by the Athenian customs called him (c.430) to Athens to obtain redress. Failing in his mission, he betook himself to the study of philosophy and to teaching geometry. He wrote the first elementary text-book on geometry, but is known especially for the quadrature of certain figures which are commonly called the lunes of Hippocrates. This is the first known instance of the quadrature of a curvilinear figure. One of the propositions in its simplest form asserts that if semicircles be described upon the three sides of an isosceles triangle, as shown in the accompanying figure, the area of the triangle equals the sum of the areas of the lunes—i.e. $T = A + B = 2A$. It is easily proved that $T = A + B$ even if the triangle is not isosceles. These propositions on the lunes are further interesting as being the oldest extant specimens of geometric proofs by reasoning.



LUNES OF HIPPOCRATES.

Hippocrates also attempted the problem of duplicating the cube, and reduced it to that of finding two means between one line and another of double its length. He is also credited by Proclus with inventing the process of geometric reduction, consisting in passing from one proposition to another, which being mastered, the one proposed necessarily follows. Consult: Tannery, "Hippocrate de Chios et la quadrature des lunules," in the *Mémoires de Bordeaux* (1878).

HIPPOCRATIC OATH. An oath taken by young men in the early days on entering upon the practice of medicine. In ancient times the oath was ascribed to Hippocrates, and is probably authentic. It runs as follows: "I swear by Apollo, the physician, by Æsculapius, by Hygieia, Panacea, and all the gods and goddesses, that according to my ability and judgment I will keep this oath and stipulation: to reckon him who teaches me this art equally dear with my parents; to share my substance with him and to relieve his necessities if required; to look upon his offspring upon the same footing as my own brothers; and to teach them this art if they shall wish to learn it, without fee or stipulation; and that by precept, lecture, and by every other mode of instruction I will impart a knowledge of this art to my own sons, to those of my teachers, and to disciples bound by a stipulation and oath, according to the law of medicine, but to no others. I will follow that system of regimen which, according to my best judgment, I consider best for my patients, and abstain from whatever is injurious. I will give no deadly medicine to any one if asked, nor suggest any such counsel. Furthermore, I will not give to a woman an instrument to procure abortion. With purity and holiness will I pass my life and practice my art. I will not cut a person who is suffering with stone, but will leave this to be done by those who are practitioners of such work. Into whatever houses I enter I will go for the advantage of the sick, and will abstain from every voluntary act of mischief and corruption, and, further, from the seduction of females or males, bond or free. Whatever in connection with my professional practice, or not in connection with it, I may see or hear, I will not divulge, holding that all such things should be kept secret. While I continue to keep this oath inviolate, may it be granted to me to enjoy life and the practice of my art, respected always by all men; but should I break through and violate this oath, may the reverse be my lot." It is said that a similar oath was used in the Middle Ages, after the discontinuance of the use of the Hippocratic oath. Some medical colleges of to-day impose a simpler obligation in the form of an admonition and an affirmation, to which the graduating class assents.

HIPPOCRENE, hĭp'pō-krē'nē (Lat., from Gk. Ἱπποκρήνη, *Hippokrēnē*, from ἵππος, *hippos*, horse + κρήνη, *krēnē*, spring). A fountain on Mount Helicon, about 20 stadia above the Grove of the Muses, and, according to the mythical account, produced by a stroke from the hoof of the horse Pegasus (q.v.). It was sacred to the Muses. It is probably to be identified with the *Kryopēgadi* ('cold spring'), on the north side of the southeast peak of Mount Helicon. See HELICON.

HIPPODAMIA, hĭp′pô-dȧ-mī′ȧ (Lat., from Gk. Ἱπποδάμεια). Daughter of Œnomaus, King of Pisa, in Elis, and the pleiad Sterope. As an oracle had declared that Œnomaus should be killed by his son-in-law, the King required that each suitor should engage in a chariot-race. The suitor with Hippodamia in his chariot was allowed so much time as Œnomaus needed for a sacrifice to Poseidon. As his horses were a gift of the god, the King always caught the luckless suitor, whom he slew in passing with his spear. Pelops bribed Myrtilus, the King's charioteer, to weaken the linch-pin, and Œnomaus was dragged to death by his own horses. After his victory Pelops threw Myrtilus into the sea, and was cursed by the drowning man for his faithlessness. Hippodamia became the wife of Pelops and the mother of Atreus and Thyestes. She afterwards induced them to murder their half-brother, Chrysippus, and then fled to Midea, in Argolis, where she died. Her body was brought by Pelops to Olympia and interred in the sacred inclosure of the Altis, where she was worshiped in later times. The preparations for the chariot-race formed the subject of the sculptures in the east pediment of the great temple at Olympia, and Hippodamia appears not infrequently on vases.

Hippodamia was also the name of the wife of Pirithous, at whose wedding the conflict occurred between the Centaurs and Lapithæ (q.v.).

HIP′PODROME (Lat. *hippodromus*, from Gk. ἱππόδρομος, race-course, from ἵππος, *hippos*, horse + δρόμος, *dromos*, course, from δραμεῖν, *dramein*, to run). The Greek name for the place set apart for horse and chariot races. The dimensions seem to have varied at different places. In construction and all important points of arrangement it was the counterpart of the Roman circus (q.v.). The dimensions (at Olympia) have recently come to light in a Greek MS. in Constantinople. The total circuit was eight stadia (about .95 mile), but the length of the actual race-course was only six. It is also said that pairs of colts made three circuits, pairs of grown horses or four colts made eight rounds, and the four-horse chariots twelve. As this would make the latter race cover about eight and a half miles, some modern scholars believe that not the circuit, but merely the length of the hippodrome, is meant, and that therefore the length of the contests should be reduced one-half. A race of over eight miles must have been a contest of endurance rather than of speed. The breadth at Olympia was about 350 feet. At Olympia the starting was effected by means of the *aphesis*, a system of stalls arranged along the two sides of a triangle, the apex of which was to the right of the centre line, and apparently so arranged that the distances from the turning-point to the angles at the base of the triangle were equal. The start was effected by setting free the chariots on the extreme right and left, and when they came abreast of the next two, by setting them free also, and so on till all were in motion. The number of starters seems at times to have been very large, as Pindar speaks of 41 chariots as competing at the Pythian games, and Alcibiades alone sent seven chariots to Olympia. The golden age of the hippodrome was during the Byzantine Empire. The blue and green factions in the hippodrome carried their animosity into all departments of the public service, and the Nika riots in Constantinople threatened to dethrone Justinian. The site of the great hippodrome at Constantinople is still called Atoneidan (the horse-place) by the Turks, and the line of the central barrier is marked by the obelisk of Theodosius, the bronze serpents that supported the Platæan tripod, and the column erected by Constantine VII. Consult: **Lehndorff,** *Hippodromos* (Berlin, 1876); Pollack, *Hippodromica* (Leipzig, 1890); Wernicke and Schöne, in *Jahrbuch des archäologischen Instituts*, ix. (Berlin, 1894) and xii. (ib., 1897); and especially the elaborate article by A. Martin, "Hippodromos," in Daremberg and Saglio, *Dictionnaire des antiquités* (Paris, 1897).

HIP′POGRIFF, or **HIP′POGRYPH** (from Gk. ἵππος, *hippos*, horse + Lat. *gryphus*, griffin, from Gk. γρύψ, *gryps*, from γρυπός, *grypos*, hook-nosed). A fabulous animal, represented as a winged horse, with the head of a griffin.

HIPPOL′ITA. (1) The Queen of the Amazons and the betrothed of Theseus, in Shakespeare's *Midsummer Night's Dream.* In *The Two Noble Kinsmen* she appears as Theseus's wife. (2) A merchant's daughter, the heroine of Wycherley's *Gentleman Dancing Master.*

HIPPOL′YTUS (Lat., from Gk. Ἱππόλυτος). In Greek legend, the son of Theseus (q.v.) and the Amazon Antiope or Hippolyte, a mighty hunter and devoted servant of Artemis, but a despiser of Aphrodite, who wreaked a terrible vengeance on him. Brought up in Troezen, he was first seen by his stepmother Phædra when a young man. She fell in love with him, and when he repulsed her advances committed suicide, leaving a letter to Theseus accusing Hippolytus of an attempt upon her virtue. Theseus besought his father, Poseidon, to avenge him, and Poseidon sent a sea monster, who frightened the horses of Hippolytus so that they ran away and dragged him to his death. Hippolytus was worshiped at Troezen. One version told how Artemis persuaded Asclepius to restore her favorite to life, and this led the Romans to identify him with the deity Virbius of Aricia. The story is best known to us through the *Hippolytus* of Euripides, which has been imitated by Seneca in his *Hippolytus* and by Racine in his *Phèdre.* Consult: Euripides, *Hippolytos*, edited by Wilamowitz-Möllendorf (Berlin, 1891); Kalkmann, *De Hippolyto Euripidis* (Bonn, 1882). On the numerous representations, especially on sarcophagi, consult: Kalkmann, "Ueber Darstellungen der Hippolytos-Sage," in the *Archäologische Zeitung* (Berlin, 1883); Robert, *Antike Sarkophagreliefs*, ii. (Berlin, 1902).

HIPPOLYTUS. The name of several saints and martyrs of the early Church, of whom the most interesting flourished in the early part of the third century. Although a very prominent man in his day, the known facts of his life are few. He was of Greek ancestry and possibly born in Rome, became a presbyter of Rome under Bishop Zephyrinus (198-217), and attracted attention by his great learning. He headed a party in opposition to Zephyrinus, and especially to his successor Calixtus, and was chosen by it their bishop. But as his opposition was probably mostly personal and on questions of policy, when Urban I. succeeded Calixtus, he was reconciled with the Roman Church. However, in 235 he went into exile to Sardinia with Pontianus, Urban's successor, and died there. He is a saint in the Roman calendar, and his day is August 13th. He was a voluminous author, but his works are now known only by fragments. Of these the most interesting is the so-called *Philosophoumena*, formerly attributed to Origen, but now thought to be the first book of a work by Hippolytus, *The Refutation of All the Heresies.* A manuscript giving books iv.-x., previously unknown, was discovered at Mount Athos in 1842. In them Hippolytus gave personal details which threw new light upon his life. It was first printed in its entirety by Emmanuel Miller (Oxford, 1851), who, however, attributed it to Origen. Baron Bunsen was the first (1852) to assign it to Hippolytus. Hippolytus's works are given in Migne, *Patrol. Græca*, x., and much better by Bonwetsch and Archelis (Leipzig, 1897 sqq.); they are translated in *Ante-Nicene Fathers*, v. Consult Neumann, *Hippolytus von Rom in seiner Stellung zu Staat und Welt* (Leipzig, 1901).

HIPPOMANE, hĭp-pŏm'ȧ-nē. See MANCHINEEL.

HIPPOM'EDON (Lat., from Gk. Ἱππομέδων). In Greek mythology, the son of Aristomachus of Argos, and one of the seven leaders in the expedition against Thebes in which he was killed by Ismarus.

HIPPOM'ENES (Lat., from Gk. Ἱππομένης). The son of Magareus and descendant of Poseidon. He was the lover of the Bœotian damsel Atalanta, and won her, with Aphrodite's help, by surpassing her in the foot-race in which all suitors were obliged to take part. See ATALANTA.

HIPPO'NAX (Lat., from Gk. Ἱππῶναξ). A Greek poet of the sixth century B.C.; after Archilochus and Simonides, the third of the great iambic poets of Greece. Expelled from Ephesus about B.C. 542 by the tyrant Athenagoras, he took refuge in Clazomenæ. There his deformed figure and malicious disposition exposed him to the caricature of the Chian sculptors Bupalus and Athenis; but he revenged himself by issuing against them a series of such bitter satires that tradition says they hanged themselves. These are in thought and execution inferior to the similar works of his predecessor, Archilochus. His coarseness of thought and feeling, his rude vocabulary, his want of charm and taste, and his numerous allusions to matters of merely local interest, make him a unique figure in Greek literature. He invented epic parody, and the four opening lines of a parody on the *Iliad* have been preserved in *Athenæus* (p. 698f.). He also invented the choliambic or Hipponactean measure, in which a trochee or spondee is substituted for the final iambus in an iambic trimeter. The fragments of his poems are edited by Bergk, *Poetæ Lyrici Græci*, vol. ii. (Leipzig, 1900).

HIPPOPH'AGY (from Gk. ἱπποφάγος, *hippophagos*, horse-eating, from ἵππος, *hippos*, horse + φαγεῖν, *phagein*, to eat). The eating of horse-flesh. That semi-civilized nations eat horse-flesh is well known. In Spain a banquet comprising roasted horse-flesh among the viands is given at the present day.

In 1855 and 1856 there was a good deal of discussion in Paris relative to the formal introduction of horse-flesh into the meat-markets, and some of the more enthusiastic advocates of the plan formed themselves into a society. French skill was exercised abundantly in disguising the somewhat coarse taste and odor of horse-flesh.

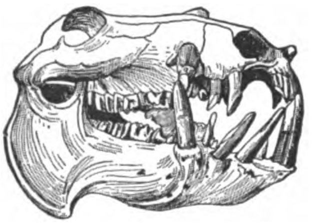
In 1866 there was official recognition of the introduction of this kind of food into the market, under such restrictions as were deemed suitable. The prefect of the Seine issued an ordinance in June of that year, recognizing horse-flesh as human food, establishing special slaughter-houses or abattoirs for slaying horses under specific regulations. The animals were to be killed by those specially appointed in presence of a veterinary inspector, who was also to stamp or seal every joint of meat after inspection. All restaurateurs who used horse-flesh were to acquaint their customers with the fact. During the French International Exhibition of 1867 some of the humbler restaurants of Paris made great use of horse-flesh; and during the siege of Paris, in 1870-71, horse-flesh was extensively used as food. At the present time the eating of horse-flesh is not at all uncommon in European countries. It is very largely employed in the manufacture of sausages, and in Paris alone there are at least 193 places where the meat of horses, mules, and donkeys is for sale. The objection to the use of good horse-flesh for food is wholly sentimental, and its cheap price, six to ten cents per pound, is of great advantage for the poorer classes.

HIP'POPOT'AMUS (Lat., from Gk. ἱπποπόταμος, *hippopotamos*, river-horse, from ἵππος, *hippos*, horse + ποταμός, *potamos*, river). A huge, thick-skinned, almost aquatic, kind of mammal of tropical Africa, two living and many fossil species of which constitute the family Hippopotamidæ. This family is closely allied to the swine, and it would be more nearly accurate to call them 'river-hogs' rather than 'river-horses.' They differ from the swine and peccaries, however, in having a broad rounded muzzle, with the nostrils superior and no trace of a terminal disk (see SWINE); in having all the toes touch the ground and nearly equal in size; in the continual growth of the lower incisor teeth; and in other anatomical details. The family seems always to have been confined to the Old World; but remains of various species have been found in the Upper Tertiary rocks of Burma and Algeria, and others, nearer the modern type, in the Pliocene and later formations of India and of Southern Europe. Within the historic period, at least, the hippopotami have been restricted to Africa (unless one may believe, from biblical references to the 'behemoth' (q.v.), that it has inhabited Palestine since the origin of tradition), where it seems to have occupied all the larger lakes and rivers until locally exterminated by man. Anciently it possessed the whole Nile, and was killed by the early Egyptians by means of harpoons; but for centuries none have been seen below the cataracts. When white settlements began at the Cape of Good Hope, 'hippos' lived in the most southern of African rivers, but gradually disappeared, until now the upper Limpopo marks the southern boundary of their habitat. They are likely to die out of the East African rivers speedily, but the endless marshes of the upper Nile and its tributaries, and the vast swamps and waterways of the Congo basin, will preserve the animal indefinitely. These remarks refer to the familiar species (*Hippopotamus amphibius*), in addition to which there exists on the Guinea coast a second species (*Hippopotamus Liberien-*

sis), a pygmy in size and more swine-like in habits.

The Common Hippopotamus. This is, next to the elephant, the bulkiest of land mammals. Old males are from 12 to 14 or more feet long, stand nearly four feet high at the shoulder, and weigh about four tons. The body is elongated, barrel-shaped, and the belly nearly touches the ground, while the swollen, ugly head seems too heavy even for the massive neck, and the animals, when out of the water, usually rest the chin upon each other or some support. The body is carried upon short pig-like legs, having four toes upon each foot, each covered with a round, black hoof, and resting flat upon the ground, but connected by webs. The skin is two inches thick in some places, is spongy, like that of a walrus, rough, warty, and covered with a network of fine wrinkles, and it varies in color in the male from dark leather-brown to bluish gray, more or less spotted. The females usually are of lighter tint, and both sexes are lighter on the belly. The skin is naked except for the bristles on the muzzle, and a few tufts of short hair upon the sides of the head and neck, and on the ears and tail. It contains a great quantity of an oily substance which exudes from the pores; and under excitement this flows out copiously and is tinctured with blood, producing the 'bloody sweat' for which this beast is famous. The tail is short and laterally compressed.

Habits and Food. The hippopotamus is most at home in the water, and aquatic vegetation is its natural fare. To this its organization has become particularly adapted. It swims well, makes long excursions, sometimes into open water, and even goes some distance out into the salt estuaries of rivers. It is able to dive quickly, but its ordinary method of submergence is quietly to sink to the bottom, where it is said that it may walk about, browsing, for several minutes. To this end not only its nostrils, but its small ears are closed by sphincter muscles, keeping out the water; and its infolded lips prevent an inrush of water in feeding. The nostrils and eyes are so high that it need only expose an unnoticeable fraction of the face in order to breathe and look about, while its entire body is safely hidden beneath the surface. The peculiar dentition and digestive organs have reference to this manner of life, and to a diet of coarse herbage. The enormous mouth, which may open to the extent of four feet, is furnished with numerous ivory-capped grinders, and with powerful rooting and biting teeth in front. The larger teeth are the tusks or canines, which are curved backward, and have their ends obliquely leveled off by mutual attrition. These tusks and the incisor teeth continue to grow during the life of the animal, and their points turn downward. In this respect these teeth differ from the pig's, which form roots.



SKULL AND TEETH OF HIPPOPOTAMUS.

The hippopotamus cuts grass or corn as if it were done with a scythe, or bites with its strong teeth a stem of considerable thickness neatly through; it also tears up the marsh growth by means of its great tusks. Its food consists chiefly of the plants which grow in shallow waters and about the margins of lakes and rivers; and probably it renders no unimportant service in preventing slow streams from being choked up by the luxuriance of tropical vegetation. It often, however, leaves the water, chiefly by night, to feed on the banks, and makes inroads on cultivated fields, devouring and trampling the crops. As considerable quantities of such fare must be consumed in order to obtain sufficient nutrition, the hippopotamus possesses an enormous stomach, the axial length of which is eleven feet, while the greater curvature measures fifteen feet. It fills nearly the entire length of the body, and is divided into three distinct compartments, of which the third is cylindrical, with the pylorus almost in the pelvis. It is mainly in this third compartment that assimilation occurs.

These beasts are gregarious; herds of a dozen or twenty gather where food is plentiful, and they seem to remain in one locality all their lives unless much disturbed. During the day they lie hidden, usually asleep, on some marshy islet, and betray their presence, if at all, by their snorting, coughing, or grunting, which in anger becomes a hoarse roar. It is at night that they are most active, feed most, and leave the water to graze on shore or invade neighboring fields of millet and the like. Their excursions sometimes extend seven or eight miles in a night, and regular paths are trodden through the waterside jungle, in which the negroes dig pits or arrange deadfalls for the capture of the animal. Usually only one offspring is born annually, after a gestation of 7½ months. The mother takes it into the water immediately, but, as it is unable to swim, supports it upon her neck until it learns how to take care of itself; she also protects it most assiduously, not only from crocodiles and other enemies, but from the rage of the males, who will kill infants unless prevented. The young nurse under water, and continue to grow for five years, after which they may live twenty-five or more years.

Though the brain of this animal is very small and its life a dull one, it is by no means stupid. It quickly learns, when much hunted, not to expose itself, nor to indulge in a whale-like snort when it rises to breathe. Its scent apparently is very keen, and its vigilance great. Captives learn the names and faces, voices and customs of their keepers, and exhibit much general intelligence. They are naturally very timid, yet curious, and subject to fits of panic or rage. Hence small boats are always endangered by going near them; and even large steamboats have been attacked. A wounded or enraged hippopotamus is regarded by sportsmen as perhaps the most dangerous beast to be encountered. Pure malice seems frequently to dictate their actions. The natives more often get them by strategy than by bold attack. The negroes eat the flesh and fat, and make some use of the hide. By white men the animals are shot mainly for sport and near the coast for the sake of the hide, out of which coverings for handles (shrunk on), bull-whips, and polishing wheels are made; also for the ivory of the great canine teeth, which sometimes exceed 30 inches in length; but this ivory is not as much valued now as it was early in the nineteenth century, when it was in demand for the making of artificial teeth.

The Pygmy or Liberian Hippopotamus. Concerning this small species not much is known. It appears to be restricted to the Guinea coast, and to be much less aquatic than its large relative. It wanders and seeks its food in swampy woods, after the manner of a pig, but never gathers in herds. It is about 5½ feet long, 2½ feet tall, and weighs about 400 pounds. In color it is bluish black along the back, paling gradually to greenish white on the ventral parts. The fact that it has only one pair of incisor teeth, instead of two, in the lower jaw, led Leidy to classify it in a separate genus (Chæropsis).

Fossils. Remains of the hippopotamus have been found in the Pliocene and Pleistocene deposits of India, Burma, Algeria, and Europe. Hippopotami roamed in herds over England not very long before the period of the earliest human occupation, and the remains of individuals of all sizes have been found in the gravels near Cambridge. Remains of dwarf species, associated with those of dwarf elephants, are found in the cave and fissure deposits of the islands of Sicily and Malta. No remains of fossil hippopotami have yet been found in America.

Bibliography. Consult general works, especially Wright, *Standard Natural History*, vol. v. (Boston, 1885); Oakley and Boyd-Dawkins in *Cassell's Natural History*, vol. ii. (New York, 1884). Consult also the writings of African explorers and sportsmen, especially the earlier ones, as Livingstone, Gordon-Cumming, and Speke; also Schweinfurth, *Heart of Africa* (London, 1873); Holub, *Seven Years in South Africa* (London, 1881); Baker, *Wild Beasts and Their Ways* (London, 1890).

See Plate of Tapirs and Hippopotamus; and Colored Plate of Pachyderms.

HIP'PO RE'GIUS. See Hippo.

HIPPOTH'OON (Lat., from Gk. Ἱπποθόων). The hero of the Attic tribe Hippothoontis. He was the son of Poseidon and Alope, the daughter of Cercyon of Eleusis, and was exposed as a newborn infant, but was suckled by a mare and brought up by shepherds. When Theseus overcame and killed Cercyon, he transferred the government to Hippothoon.

HIPPU'RIC ACID (from Gk. ἵππος, *hippos*, horse + οὖρον, *ouron*, urine), $C_9H_9NO_3$. A compound of great interest, both to the chemist and to the physiologist. It derives its name from its having been first discovered in the urine of the horse, and that fluid, or the renal secretion of the cow, affords us the best and readiest means of obtaining it. The fresh urine is boiled with a slight excess of milk of lime and filtered; the filtrate is evaporated to a small volume, cooled, and acidified with hydrochloric acid, when hippuric acid separates out in the form of fine needle-like crystals. When obtained by a process of slow crystallization, the crystals of hippuric acid are moderately large, at first colorless, but subsequently becoming milk-white, four-sided prisms, which are devoid of odor, but have a faintly bitter taste. They dissolve readily in boiling water and in spirit, but are only sparingly soluble in cold water and in ether. Its chemical name is benzoyl-amido-acetic acid, $C_6H_5CO.NH.CH_2COOH$, and it may be prepared artificially from benzoic acid, C_6H_5COOH, and glycin, NH_2CH_2COOH. When boiled with strong mineral acids, hippuric acid takes up water and splits up again into its chemical components, benzoic acid and glycin. It is a normal constituent of the urine of the horse, cow, sheep, goat, hare, elephant, etc., and most probably is to be found in the urine of all vegetable feeders. In normal human urine, if the food is an ordinary mixed diet it occurs in very small quantity, but is increased by an exclusively vegetable diet, and in the well-known disease diabetes. Although hippuric acid usually occurs in mere traces in human urine, we can artificially produce it at will in the body, and cause it to be eliminated in comparatively large quantity. If we swallow benzoic acid, it seems to take up the elements of glycin in its passage through the system, and thus to form hippuric acid, which appears abundantly in the urine. Hippuric acid is formed in the animal body not only from benzoic acid itself, but from any substance (e.g. kinic acid) that may be readily transformed into benzoic acid. Some such substances are contained in grass, hay, and in many berries, and are also found among the products of the putrefaction of proteids, especially those of vegetable origin. In carnivora the formation of hippuric acid has been shown to take place chiefly in the kidneys; in the herbivora, however, benzoic acid is largely transformed into hippuric acid even if the kidneys have been removed. In birds the ingestion of benzoic acid causes the formation not of hippuric, but of œnanthylic acid. The hippuric acid which occurs in the animal organism exists in combination with bases, chiefly as hippurate of soda and hippurate of lime. The last-named salt can be obtained by the mere evaporation of the urine of the horse.

HIPPURITES, hĭp′pû-rī′tēz (Neo-Lat. nom. pl., from Gk. ἱππουρις, *hippouris*, horse-tailed, from ἵππος, *hippos*, horse + οὐρά, *oura*, tail). A remarkable fossil pelecypod in which one valve is a greatly elongated cone and the other a flattened lid. The lower conical valve was attached to the sea bottom by its apex. The upper lid-like valve is provided on its lower surface with elongated processes that project downward into pits in the cavity of the lower valve, and act as levers to raise the lid. Hippurites shells are exceedingly abundant in the shallow-water deposits of the Middle and Upper Cretaceous in the Mediterranean region of Europe. See Rudistæ.

HIPURINA, ē-pōō′rē-nä′. A cannibal tribe of the middle Purus of Western Brazil, one of the most warlike on the river, and estimated at perhaps 2500 souls. They live in long, low houses built of converging poles, and use poisoned arrows with heads notched so as to break off in the wound. They wear only the breech-cloth, but are clean and self-respecting.

HIRADO, hē-rä′dō (in old books Firando). An island in the northwest of the entrance to the Bay of Omura, off the coast of Hizen, Japan, with a capital of the same name containing 10,600 inhabitants. It was made famous in the sixteenth century as the place of welcome to the Portuguese (the first foreigners to visit Japan), and later, in 1600, to the Dutch, and in 1609 to the English. From 1609 to 1611 the English, and from 1609 to 1640 the Dutch had a trading station here, the latter in 1640 being transferred to the little artificial island of Deshima at Nagasaki. Consult *The Diary of Richard Cocks*, Hakluyt Society (London, 1883).

HI'RAM, or **HURAM** (perhaps an abbreviation of *Ahiram*, brother of the High One, or, Ahi is exalted). (1) King of Tyre. He is represented as David's friend and ally, and assisted him in the building of his palace by contributions of timber and labor (II. Sam. v. 11; I. Chron. xiv. 1). Upon Solomon's accession Hiram sent cedar and other timber and skilled workmen for the building of the temple, in return for which Solomon paid a yearly tribute (I. Kings v. 1-12). The two kings remained constant friends, and Hiram supplied Solomon with a navy (I. Kings ix. 26-28; x. 22). Hiram waged a successful war against Cyprus, and fortified the island of Tyre. The question has been raised whether the same King of Tyre could have been the contemporary of both David and Solomon, both of whom had long reigns. If we assume, however, that David undertook his building operations during the latter part of his reign, there is no reasonable ground for doubt; though it is, of course, possible that, for David's reign, we should substitute the name of Abibaal, the father of Hiram. (2) According to I. Kings vii. 13, seq., a Tyrian artificer who was sent by Hiram, the King of Tyre, to assist in the building of Solomon's temple.

HIRAM COLLEGE. An institution of learning at Hiram, Ohio, founded in 1850 as the Eclectic Institute. It became a college in 1870, and had in 1902 366 students, of whom 162 were enrolled in the college, 135 in the preparatory department, 60 in music, and 9 in oratory. The library contains about 6000 volumes. The value of the college property is $275,000; and the annual income $13,000.

HI'REN. A prostitute in Peele's play *The Turkish Mahomet and Hiren, the Fair Greek*, and in William Barksteed's poem *Hiren, the Fair Greek* (1611). The character became proverbial among Elizabethan dramatists.

HIRING. A contract by which one employs, for a limited time, another's property or labor for some consideration or reward. See BAILMENT; also such titles as AGENT; CARRIER, COMMON; CHARTER PARTY; LEASE; MASTER AND SERVANT. Where the thing hired is land or houses, see LANDLORD AND TENANT.

HIRLAS HORN, THE. A long, blue, silver-rimmed drinking-horn, mentioned in a Welsh poem of the same name, written by Owain, Prince of Powys, in the twelfth century. Owain drains it to the health of his assembled chiefs on the night after a battle, as the exploits of each are rehearsed.

HIRN, ėrn, GUSTAVE ADOLPHE (1815-90). A French physicist, born at Logelbach, near Colmar. When he was nineteen he entered his grandfather's cotton factory as chemist; afterwards he acted as engineer, and began his valuable researches on mechanics, and especially on calorics. He was made a member of the French Academy of Science in 1867; in 1880 founded a meteorological observatory near Colmar; and later devoted himself to astronomy. Hirn was educated in the shop, and his works are marked by much practical criticism of mere academic theory. They include: *Théorie mécanique de la chaleur* (3d ed. 1875-76); *Analyse de l'univers* (1869); *Mémoire sur les anneaux de Saturne* (1872); *Les pandynamomètres* (1876); *Etude sur une classe particulière de tourbillons* (1878); *Recherches expérimentales sur les relations entre la résistance de l'air et sa température* (1882); *La vie future et la science moderne* (1882); and *Constitution de l'espace célcste* (1889).

HIROSAKI, hē'rō-sä'kē. A town of Japan, situated in the northern part of Nippon, 22 miles by rail from Asmori (Map: Japan, G 3). It contains ruins of an old castle and a museum. The chief product is lacquered ware. Population, in 1898, 34,771.

HIROSHIMA, hē'rō-shē'mȧ. The capital of the Japanese Province of Aki and of the Prefecture of Hiroshima, situated at the southwestern end of Hondo, about three miles inland (Map: Japan, C 6). It lies in a beautiful region at the foot of a hill, and contains a number of fine temples, a park, and tea-houses. Opposite the city is situated the sacred island of Miyajima or Itsukushima, with its celebrated Shinto temple. Commercially, Hiroshima is considered the most important place west of Kobe, and forms the centre of the trade in lacquered ware, bronze, and other objects of art. Population, in 1898, 122,306.

HIRPINI, hēr-pī'nī (from Sabine *hirpus*, wolf). A people of ancient Italy, who inhabited the southern portion of Samnium. They have been considered by some authorities as merely a Samnite tribe, while by others they are looked upon as an independent nation. The country they inhabited was the wild and mountainous district traversed by the Sabatus, Calor, and Tamarus, tributaries of the Vulturnus, and on the east side of the Apennine ridge by the upper course of the Aufidus. In the early history of Rome the Hirpini are found identifying themselves with their Samnite neighbors against their common foes. They seem to have been subdued in the early part of the third century B.C., as in B.C. 268 Beneventum, the key of all their military positions, was colonized by Roman settlers. In the Second Punic War, revolting from their conquerors, they joined the Carthaginian invaders, and though they were unable to recapture their stronghold of Beneventum, they remained faithful to Hannibal till the defeat of Hasdrubal at the Metaurus restored the empire of Italy to his opponents. In the year of that event the Hirpini made peace with their old masters by betraying into their hands the garrisons of their allies. From this time till the outbreak of the Social War, the Hirpini seem to have continued steadfast in their allegiance. On that occasion, however, they set the example of revolt to the allies, and might have become formidable enemies had not the rapid successes of Sulla induced them to repair their error by a complete submission. At the close of this war the Hirpini obtained the franchise, and do not again appear in history as an independent people.

HIRSCH, hērsh, AUGUST (1817-94). A German physician, born at Danzig, where he practiced after studying at Berlin and Leipzig. In recognition of his studies on malarial fever and his work, *Handbuch der historisch-geographischen Pathologie* (2d ed. 1881-83), he was in 1863 made professor at Berlin. In 1873 he was a member of the German Cholera Commission, studied the conditions of Posen and West Prussia, and published a valuable report (1874). He studied the plague in Astrakhan in 1879 and 1880, and in the latter year wrote a report to his Government. His more important writings are: *Die Meningitis Cerebro-spinalis Epidemica* (1866); *Geschichte der Augenheilkunde* (1877); *Geschichte der medizinischen Wissenschaften in Deutschland* (1893); a revision of Hecker's collected writings, under the title *Die grossen Volkskrankheiten des Mittelalters* (1865). He edited *Biographisches Lexikon der hervorragenden Aerzte aller Zeiten und Völker* (1884-88); and with Virchow the *Jahresbericht über die Fortschritte und Leistungen der Medizin* (1866 et seq.).

HIRSCH, Carl (1858—). A German composer, born at Wemding, Bavaria. When only eighteen he became a teacher in the Violin-Makers' School at Mittenwald, and from that time on held many important positions, among them: church music-director at Munich (1885-87); music-director at Mannheim (1887-92); at Cologne (1892-93); at Elberfeld (1893—); and director of the Gesangschule, the Liedertafel, the Philharmonic concerts at Elberfeld. But it is as a composer that Hirsch is best known, his *a-cappella* choruses, which are very numerous, and his cantatas being widely known and used. Of the latter *Die Krone im Rhein* and *Landsknechtsleben* are representative. His songs and ballads are scarcely inferior to his male choruses.

HIRSCH, Emil Gustav (1852—). An American rabbi, born in Luxemburg, the son of a prominent Jewish theologian who in 1866 became minister of the Reformed Congregation in Philadelphia. He studied at the University of Pennsylvania, and in 1872 went to Berlin for post-graduate work. He was rabbi in Baltimore (1877), and in Louisville, Ky. (1878-80), but did his greatest work in Chicago, whither he went in 1880 as minister of the Sinai Congregation. He took some part in politics as a member of the Republican Party; was president of the Chicago Public Library Board (1888-97); and in 1892 became professor of rabbinical literature in the University of Chicago. From 1880 to 1887 he edited the Milwaukee *Zeitgeist*, and then undertook the editorial charge of the *Reform Advocate*. As a lecturer and writer he is closely connected with advanced Judaism and with philanthropy.

HIRSCH, Jenny (1829-1902). A German author and reformer, born at Zerbst, where she was a tutor for several years. She went to Berlin in 1860; wrote for the *Bazar*, under the pseudonym J. N. Heynrichs, until 1864; and about that time became interested in woman's rights and female education. A member of the Women's Congress of 1865 at Leipzig, and for many years a leader in the Lette-Verein, she edited *Der Frauenanwalt* (1870-82); and, with Lina Morgenstern, *Deutsche Hausfrauenzeitung* (1887-92); with Mary Wall wrote *Haus und Gesellschaft in England* (1878); in 1881 published *Fürstin Frau Mutter*, and after it many other tales. Among them are the following titles: *Die Erben* (1889); *Vermisst* (1894); *Löwenfelde* (1896); *Der Amtmann von Rapshagen* (1890); *Schuldig* (1899); and *Camilla Feinberg* (1901). Under the title *Hörigkeit der Frau* (3d ed. 1891), she translated into German Mill's *Subjection of Woman*, and wrote a *Geschichte der 25 jährigen Wirksamkeit des Lette-Vereins* (1892).

HIRSCH, Joseph (1836-1901). A French engineer, of Jewish family, born at Lyons. Educated there, at the Ecole Polytechnique and the Ecole des Ponts et Chaussées, he worked on the canal at Sarrebourg (1866), and there invented the Mittersheim siphon for the automatic control of reservoirs. From 1876 to 1898 he was professor of steam machinery at the Ecole des Ponts et Chaussées, and from 1886 until his death at the Conservatoire des Arts et Métiers. He contributed to the *Annales* of the former school; as member of the juries of award at the Expositions of 1878 and 1889 and as president of the jury of 1900, he wrote valuable reports and lectured on the machinery exhibited at these expositions; and was the author of many treatises on machinery, including *Théorie des machines aéro-thermiques* (1874-75). His contributions to Lechalas's *Encyclopédie* should also be mentioned.

HIRSCH, Maurice, Baron de (Maurice de Hirsch de Gereuth) (1831-96). An Austrian Jewish financier and philanthropist. He inherited his father's wealth in 1869, and greatly increased his fortunes by his marriage to the daughter of the senior partner of the banking firm of Bischoffsheim and Goldsmid, Brussels, with whom he had become associated. He also made large sums by building railways in Rumania and Turkey. His fortune was estimated at $200,000,000, and his income at from $15,000,000 to $20,000,000 a year. He gave to charity about $100,000,000 during his life, and the Baroness de Hirsch, on her death in 1899, bequeathed about $15,000,000 to charities. These benefactions were chiefly for the alleviation of the condition of the Jews. He gave not less than $50,000,000 to the Jewish Colonization Association, by which colonies were established in the Argentine Republic. He endowed the Galician schools with $5,000,000, and in 1888 offered $10,000,000 to the Russian Government for schools, provided no distinctions of race or religion should be made in its distribution. His offer was declined. He gave $2,500,000 to establish a fund in New York for educating and Americanizing Russian and Rumanian Jews. The sum of $1,200,000 was added to this fund by the Baroness.

HIRSCH, Max (1832-1905). A German political economist and politician, born at Halberstadt, in Prussian Saxony. He studied political economy and jurisprudence at the universities of Tübingen, Heidelberg, and Berlin, and then traveled through France and North Africa. As the result of his observations during these travels he published: *Skizze der volkswirtschaftlichen Zustände in Algerien* (1857), and *Reise in das Innere von Algerien, durch die Kabylie und Sahara* (1862). After a later journey through England and Scotland he returned home to organize trades unions among his countrymen. These soon spread all over Germany and through them and their organ, *Der Gewerkverein*, he wielded great influence. He was several times a member of the Reichstag, and was the leading spirit in a number of societies for the benefit of the laboring classes. His publications include: *Was bezwecken die Gewerkvereine?* (15th ed. 1891) and *Das Invaliditäts- und Altersversicherungsgesetz* (3d ed. 1890).

HIRSCHBERG, hėrsh'bĕrk. A manufacturing town in the Prussian Province of Silesia, situated at the foot of a mountain, 30 miles southwest of Liegnitz (Map: Prussia, F 3). The town is ancient, and is still girt about by a double line of walls. Its Protestant church, a Gothic edifice, is known for its magnitude and its excellent organ. Hirschberg has manufactures of linen, lace, machinery, paper, metal, and tobacco. The town was founded at the beginning of the eleventh century. Population, in 1890, 16,200; in 1900, 17,865, mostly Protestants.

HIRSCHFELD, hėrsh'fĕlt, Gustȧv (1847-95). A German archæologist, born at Pyritz, in Pomerania. He was educated at Tübingen, Leipzig, and Berlin, and was sent by the Prussian Archæological Institute in 1870 to Greece, Italy, and Asia Minor. From 1875 to 1877 he had charge of the excavations at Olympia, and in 1882 traveled again in Asia Minor. He was appointed professor of archæology at Königsberg in 1878. Besides many articles in the archæological journals he wrote: *Tituli Statuariorum Sculptorumque Græcorum* (1871); *Athena und Marsyas* (1872); *Paphlagonische Felsengräber* (1885); *Berichte über alte Geographie* (1885); *Die Felsenreliefs in Kleinasien und das Volk der Hittiter* (1887); *Griechische Inschriften des Britischen Museums* (1893); and contributed to the first two volumes of *Ausgrabungen zu Olympia* (1877-78). *Aus dem Orient* was posthumously published (1897).

HIRSCHFELD, Otto (1843—). An eminent German classical philologist and historian, born at Königsberg. After having taught at Göttingen, Prague, and Vienna, he was in 1885 appointed to the chair of ancient history in the University of Berlin. Of his historical writings the most important is his *Untersuchungen auf dem Gebiete der römischen Verwaltungsgeschichte* (1876). He rendered especial service to classical learning as editor of Latin inscriptions: *Inscriptiones Galliæ Narbonensis Latinæ* (1888); supplement to the *Corpus Inscriptionum Latinarum*, vol. iii. (ib., 1893); *Inscriptiones Aquitaniæ et Lugdunensis* (1899).

HIRT, Herman (1865—). A German philologist. He was born at Magdeburg, wrote on German metres (*Untersuchungen zur westgermanischen Verskunst*, 1889), edited Schopenhauer's *Parerga* (1890), and then devoting himself to Indo-Germanic philology made special studies on accent, writing *Der indogermanische Accent* (1895) and *Der indogermanische Ablaut, vornehmlich in seinem Verhältnis zur Betonung* (1900). Hirt, who became professor at Leipzig, made valuable contributions to Burgmann and Streitberg's *Indogermanische Forschungen*, on the morphology of case endings. In 1902, he published *Handbuch der griechischen Laut- und Formenlehre*, the first volume of a series of Indo-Germanic text-books of which he is editor.

HIRTH, hėrt, Friedrich (1845—). A German sinologue, born at Gräfentonna, Saxe-Gotha. He was educated at the universities of Leipzig, Berlin, and Greifswald (Ph.D., 1869), and from 1870 to 1897 was in the Chinese maritime customs service. In 1902 he was appointed to the professorship of Chinese in Columbia University (New York City). A collection of Chinese manuscripts and printed books made by him is in the Royal Library at Berlin, and another of porcelains of considerable historical importance in the Gotha Museum. As an investigator he conducted researches in Chinese literature by imitation of the methods of classical philology. His chief publications include: *China and the Roman Orient: Researches Into Their Ancient and Mediæval Relations as Represented in Old Chinese Records* (1885); *Ancient Porcelain: A Study in Chinese Mediæval Industry and Trade* (1888); *Text-Book of Documentary Chinese* (2 vols., 1885-88); *Chinesische Studien* (vol. i., 1890); *Ueber fremde Einflüsse in der chinesischen Kunst* (1896); and many papers on subjects connected with Chinese literature.

HIRTIUS, hĕr'shĭ-ŭs, Aulus (B.C. 90-43). A personal friend of Julius Cæsar, under whom he served in Gaul, and who in B.C. 46 nominated him as one of the ten prætors. After the death of Cæsar he became consul, declared against Antony, and headed a reënforcement for Octavius. While leading an assault on Mutina (Modena) he was killed. It is said that he was the author of the eighth book of Cæsar's *Commentaries on the Gallic War.*

HIRUDO, hĭ-rōō'dō, Hirudinea. See Leech.

HI'RUNDIN'IDÆ (Neo-Lat. nom. pl., from *hirundo*, swallow). The swallow family. See Swallow.

HIRZEL, hėr'tsĕl, Salomon (1804-77). A German publisher and an authority on Goethe. He was born in Zürich, worked in the firm of Weidmann in Leipzig until 1853, and then with his brother-in-law, Karl Reimer, founded an independent publishing house, which brought out Freytag's works, Grimm's *Wörterbuch*, and the publications of the Saxon Academy, the Jablonowski Association, and the Prussian archives. Hirzel made a valuable collection of Zwingliana, which he left to the University of Strassburg. His library on Goethe was willed to Leipzig University. Hirzel wrote: *Der junge Goethe, 1764-76* (with an introduction by Bernays, 1875), and *Verzeichnis einer Goethe-Bibliothek* (1874).

HIS, hės, Wilhelm (1831-1904). A German anatomist. He was born in Basel, studied medicine there, in Berlin, Würzburg, and Vienna, and was professor at Basel (1857-72) and at Leipzig. His earlier researches were histological; afterwards he devoted himself to anatomy and, in a less degree, to embryology. He edited with Braune the *Zeitschrift für Anatomie und Entwicklungsgeschichte* (1875-92), and in 1877 took charge of the anatomical department of the *Archiv für Anatomie und Physiologie.* Among his more important publications are: *Crania Helvetica* (with Rütimeyer, 1864); *Unsere Körperform* (1875); *Anatomie menschlicher Embryonen* (1880-85); *Die anatomische Nomenklatur* (1895); and a reconstruction of the physiognomy of Bach after the discovery of his remains (1895, with Seffner).

HISCOCK, Frank (1834—). An American lawyer and legislator, born at Pompey, N. Y. He was admitted to the bar in 1855; served as District Attorney of Onondaga County in 1860-63, and was a member of the State Constitutional Convention in 1867. Elected to Congress as a Republican Representative in 1877, he won repute as a debater and leader. From 1887 to 1893 he was a member of the United States Senate.

HISHAM, hêsh-äm'. The name of several Ommiad rulers of Spain. HISHAM I. was Emir of Cordova from 788 to 796. He was a vigorous ruler and put down revolts with a firm hand. He also was successful in some expeditions against the Franks. He is, however, remembered chiefly for his personal habits. In disguise he wandered incognito about the capital, succoring the poor and oppressed, caring for the sick, and inquiring into the administration of justice. His charity and justice endeared him to his subjects.—HISHAM II., Ommiad Caliph of Cordova from 976 to 1009, succeeded to the throne before he was twelve. He had little ability and lived in seclusion, while his chief officer, Al Mansur, made conquests from the Christians. Hisham was deposed and probably murdered.—With HISHAM III., who was deposed in 1031, and died in retirement in 1036, the Ommiad caliphate in Spain came to an end.

HISPA'NIA (probably connected with Heb. *shâpân*, rabbit, from *shâpan*, to hide). The name by which the Spanish Peninsula, including the modern Spain and Portugal, was known to the Romans. By the Greeks it was called Iberia, and by the Roman poets sometimes Hesperia, the Western Land. The earliest inhabitants of whom we have any knowledge were the Iberians, a race apparently unconnected ethnically or linguistically with any other race of Europe, of which the modern representatives are the Basques of Northern Spain. But in very early times hordes of Celts crossed the Pyrenees and occupied almost the whole peninsula, pushing back or assimilating the Iberians, whence the natives were generally called Celtiberians by the ancients. The national wealth of the country—especially its silver deposits—early attracted traders and colonists. About the middle of the fourth century B.C. the Greek colony of Emporiæ (Ampurias) was founded on the northeast coast. Phœnician traders early made the circuit of the coasts, and Gades (Cadiz) was one of their permanent trading stations. The Carthaginians, driven from Sicily, Corsica, and Sardinia by the Romans, determined to conquer Spain both as a source of wealth and as a base of operations against Italy. Carthago Nova (Cartagena) was their principal town, and they soon brought almost the entire country under their sway. From here Hannibal set out to cross the Alps (B.C. 218); but his downfall at the end of the Second Punic War lost the country to the Carthaginians and placed it under Roman control. For a century or two, however, the native tribes continued in a state of semi-independence, until in the time of Augustus, who founded many colonies in Spain, the country was finally Romanized. The peninsula was divided into three provinces: *Hispania Tarraconensis*, with its capital Tarraco (Tarragona) in the north and east; Bætica in the south; and Lusitania, corresponding nearly to the modern Portugal.

HISPANIOLA, hĭs'păn-yō'lȧ. The Latinized name for Española, the island of Haiti (q.v.).

HISSAR, hĭs-sär'. The capital of a district of the Delhi division, Punjab, British India, on the West Jumna Canal, 89 miles northwest of Delhi by rail (Map: India, C 3). It is the seat of a governmental cattle farm with 43,287 acres devoted to pasturage. Hissar was founded in 1354 and has interesting archæological and historical remains. Population, 17,000.

HISSAR'LIK. See TROY.

HISTIÆA, hĭs'tĭ-ē'ȧ (Lat., from Gk. Ἱστιαία, *Histiaia*, dialectic form of Ἑστία, *Hestia*, Lat. *Vesta*), or OREUS. An ancient and important city of Eubœa, on the north extremity of the island in the District of Hellopia. It was probably founded by settlers from the Histiæotis driven out by the advance of the Thessalians. In the period following the invasion of Xerxes it passed into the hands of the Athenian League, but in B.C. 446 joined the rest of Eubœa in a revolt. When the island was reduced by Pericles, the old inhabitants of the town were expelled, and Athenian colonists settled in the neighboring village of Oreus, which soon developed into a flourishing city, and gave the popular name to the colony, though officially it was still called Histiæa. At the end of the Peloponnesian War the descendants of the old inhabitants and other Eubœans replaced the expelled Athenians, and the city remained loyal to Sparta till after the battle of Leuctra, when it joined the second Athenian League. In the war between Philip and the Athenians, Oreus was one of the centres of Macedonian intrigue, and in the confusion after Alexander's death, and later during the Roman wars, it was of considerable strategic importance. In B.C. 200 it was stormed by the Romans. After this it fell into decay.

HIS'TIÆ'US (Lat., from Gk. Ἱστιαῖος, *Histiaios*) (?-B.C. 494). A tyrant of Miletus, who guarded the bridge of boats by which the Persians had crossed the Danube when Darius invaded Scythia (B.C. 513). He refused to follow Miltiades's suggestion to destroy the bridge, and, in consequence, was rewarded by Darius with the rule of Mitylene, and with a district in Thrace. Afterwards, however, he was suspected of treason, and was detained at the Persian Court for thirteen years. Tired of this restraint, he secretly instigated the revolt of the Ionian Greeks, and was sent by Darius to suppress it. With his freedom thus recovered he openly made war against the Persians, but was defeated, and finally beheaded by Artaphernes. His head was sent to Darius, who received it with sorrow and buried it with honors.

HISTOIRE COMIQUE DE FRANCION, ē'stwär' kō'mēk' de fräN'syôN' (Fr., Comic History of Francion). A romance by Charles Sorel de Sauvigny (1622), published under the pseudonym of Nicolas du Moulinet. The chief interest of the story is in the information which it supplies of contemporary customs, and in the fact that it is one of the few realistic novels of the seventeenth century. It met with much success, but was always disavowed by its author.

HISTOL'OGY (from Gk. ἱστός, *histos*, web, from ἱστάναι, *histanai*, to stand + -λογια, *-logia*, account, from λέγειν, *legein*, to say). That branch of biological science which treats of the microscopical structure of living organisms, both animal and vegetable. The histology of plants belongs to the domain of botany, that of animals to the domain of human and comparative anatomy. Just as gross anatomy is subdivided into normal anatomy and pathological anatomy, so histology may be subdivided into normal histology and pathological histology. The term histology when unqualified is usually accepted as referring to normal histology.

HISTORY. Although the study of the microscopic structure of plants and animals may be traced to the times of Malpighi (1628-94), who discovered the blood-corpuscles, Robert Hooke, who was the first (1667) to describe plant cells, and Leeuwenhoek (1632-1723), who, with comparatively imperfect optical means, practically laid the foundations of our knowledge of the minute structure of the tissues, no definite progress in histology as a science was made until the beginning of the nineteenth century, when the compound microscope began to assume its present improved form. The great work of Bichat, entitled *Anatomie générale appliqué à la physiologie et à la médecine* (1801), marked an epoch in the development of the science of histology. Although he apparently did little actual work with the microscope, he brought to bear upon the achievements of other investigators the power of his generalizing mind, and was the first to classify tissues according to their structure. After Bichat came an epoch of histological research, during which the microscopic observations of Malpighi and Leeuwenhoek were extended in accordance with the general system of Bichat. The next great step forward was made by two botanists, Hugo von Mohl and Schleiden, who discovered the cellular basis of all plant structure. The discovery of the method of combining lenses so as to render them achromatic gave a new impulse to the study of histology, and a more perfect classification of the tissues of the body was the result, as it placed in the hands of Schwann an instrument which enabled him to demonstrate the law that all animal as well as plant tissues are composed of and develop from cells. Schleiden had already demonstrated this, which may be called the greatest discovery in histology, and therefore he and Schwann are often called the founders of the science of histogenesis, or the study of the origin of tissues, more recently pursued with great success by Reichert, Kölliker, Remak, and others. Then the microscopic anatomy of diseased structures and their mode of development came to be investigated, and the science of pathological histology took its rise. Johannes Müller is regarded as the father of this branch of histology, as he indicated the general direction in which the investigation of diseased growths should be pursued. Afterwards Virchow published his celebrated *Cellular Pathology*, and later the science was still further enriched by the labors of Billroth, Rindfleisch, Von Recklinghausen, Cohnheim, and others.

HISTOLOGY OF ANIMALS.

CELLS. The histological basis of the body structure is the cell. In general terms all tissues may be said to be composed of cells of one kind or another, and these cells are always combined with more or less intercellular substance. This intercellular substance may be very small in amount, as in the epithelial tissues, where it amounts to nothing more than a cementing material holding the cells together, or it may make up the greater part of the tissue, as in some forms of connective tissue. Cells differ in shape. They may be round, oval, cuboidal, spindle-shaped, or irregularly stellate. The intercellular substance differs greatly in structure, and it is upon the differences in density of the intercellular substance that the different degrees of hardness depend. Thus, in mucous tissue the intercellular substance is soft and gelatinous, in cartilage it is dense and firm, in bone it is infiltrated with lime salts, and is extremely hard. It was at first believed that a cell was a little bag filled with fluid, hence its name. Most animal cells are, however, small masses of living matter, called protoplasm, having as a rule no cell-wall. Cells may or may not have nuclei. It is probable that non-nucleated cells are incapable of performing certain of the higher functions of cells, e.g. that of reproduction.

All adult tissues and organs originate in the elementary layers of the embryo. What determines the lines of growth of these different cells, and why some develop to form one kind of tissue, others to form other kinds of tissues, is as yet beyond our knowledge. There are two modes of cell growth or reproduction, direct cell-division, and indirect cell-division or mitosis.

TISSUES. The tissues of the body fall into four great groups: (1) Epithelial tissue; (2) connective tissue; (3) muscular tissue; (4) nervous tissue. It is by combinations of these tissues that the different organs of the body are formed. The most widely distributed of the tissues is connective tissue, which in its various forms, as fibrous tissue, elastic tissue, cartilage, bone, etc., makes up the framework of the body. In combination with one or more of the other tissues it forms the various organs of the body, acting as their supporting framework. Thus, in the nervous system such organs as the brain and cord consist of nervous tissue held together and supported by the peculiar form of connective tissue known as neuroglia. A muscle consists of muscle-tissue bound together by connective tissue; and the various glands of the body, such as the liver or pancreas, consist of a glandular epithelium peculiar to the particular organ held together by connective tissue. See CONNECTIVE TISSUE.

Consult Delafield and Prudden, *Handbook of Pathological Anatomy and Histology* (New York, 1901). The histology of the different tissues and organs may be found described under such titles as CONNECTIVE TISSUE; MUSCLE; EPITHELIUM; NERVOUS SYSTEM; LIVER; KIDNEY, etc. See also CELL; and BLOOD.

HISTOLOGY OF PLANTS.

CELLS. Many plants consist of only a single cell; nevertheless such plants show almost infinite variety in form. The simplest are nearly spherical, but in the desmids and diatoms almost every conceivable shape is to be found and a high degree of differentiation is attained. When cells divide in only one plane and do not separate after each division a chain of cells results; when division takes place in two planes a plate of cells is formed; divisions in three planes give rise to a body several cells in thickness. In the last case considerable differentiation is likely to follow; the cells on the outside become adapted to the work of protection and absorption, some of those on the inside perform the nutritive functions, and others are specially modified for conducting materials. Even in the algæ and fungi there is a division of labor, some cells being modified for the work of protection and absorption, others for conduction, still others for reproduction. In the liverworts and mosses the specialization is carried still further, but it is in the ferns and flowering plants that difference in structure and division of labor finds its highest expression. Such differentiation of cells in form and function gives rise to tissues.

TISSUES. A tissue is a group of connected cells of like origin and structure. Tissues are therefore classified according to the form of their component cells, the thickness and chemical composition of the cell-walls, the character of their contents, etc. All cells of a very young plant are alike in having thin walls, abundant protoplasm, minute vacuoles or none, and relatively large nuclei. Such cells constitute embryonic, formative, or meristematic tissue, which is found in the higher plants in three places: (1) At the tips of the shoots and roots, where it constitutes the 'growing points,' protected in the shoot by overarching leaves which form a bud, and in the root by the root-cap; (2) one or more thin layers concentric with the stem, by which new layers of wood, cork, and bast are added to it internally; (3) where wounds are made, in which cases the meristem produces tissues that heal the wound.

In all the higher plants tissues are grouped in such a way as to form tissue systems (see ANATOMY OF PLANTS). Those there described are reduced to three by some: viz. (1) the tegumentary (equivalent to the protective); (2) the vascular (equivalent to the conducting and in part the mechanical); (3) the fundamental, a sort of limbo to which are assigned all the tissues not included in the other two systems. Of all tissues it may be remarked that the cell-walls are subject to thickening as they grow older. This thickening consists of material added to the surface of the primary wall. The successive additions are frequently unlike, and in the mature wall are apt to be distinctly stratified. The thickening is seldom uniform. Sometimes minute regions escape thickening and remain as small pits in the added layers. These pits occur at points where the protoplasm of one cell has not been completely separated from that of the other by the formation of a partition wall, but remains connected there by many very slender strands. In other cases the thickening is absent from wider areas. This leaves broader and shallower pits, which are symmetrically or irregularly distributed, and give the appearance of sculpturing of the wall (2, Fig. 1). When the thickening is restricted to spiral lines or rings, the thin walls seem to be merely supported by the thickened portions, as in spiral and annular vessels (1, 3, Fig. 1).

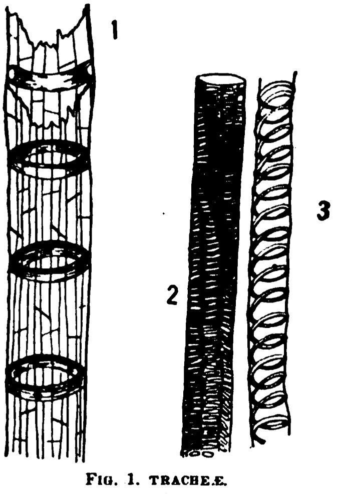


FIG. 1. TRACHEÆ.
1, Annular; 2, pitted; 3, spiral.

Only the more important kinds of tissues are here described. (1) *Parenchyma:* Cells of very various form, but mostly nearly equal in the three dimensions, usually with a thin cellulose wall containing (so long as they are functional) living protoplasm, and almost invariably separating more or less from one another to form intercellular spaces. In elongated organs parenchyma cells are likely to become elongated. The parenchyma of the leaf and the cortex of the stem may develop into very irregular forms (Fig. 2). In water plants and others in which the parenchyma develops extensive intercellular spaces (aërenchyma) the cells may become branched, some even being regularly stellate (Fig. 3). Parenchyma cells sometimes have thick walls, and thus form a transition to the sclerenchyma (see below), from which, however, they may be distinguished by the presence of living cell contents and sometimes reserve food. Such parenchyma occurs in the rhizome of many ferns. Parenchyma forms the chief nutritive and storage regions of all plants, and is especially abundant in herbaceous plants. In fleshy leaves, fruits, stems, etc., the parenchyma is greatly developed at the expense of other sorts of tissue and is there used for storage of reserve food. The outer walls of parenchyma cells, which form the surface (i.e. the epidermis), undergo a peculiar change, being infiltrated with cutin, by which they are rendered almost impervious to water. Parenchyma cells of tabular form arise from the phellogen, which

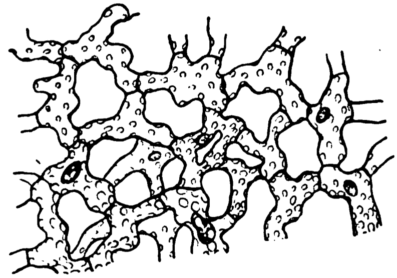


FIG. 2. IRREGULAR PARENCHYMA.
From a leaf, with only chloroplasts and nuclei shown.

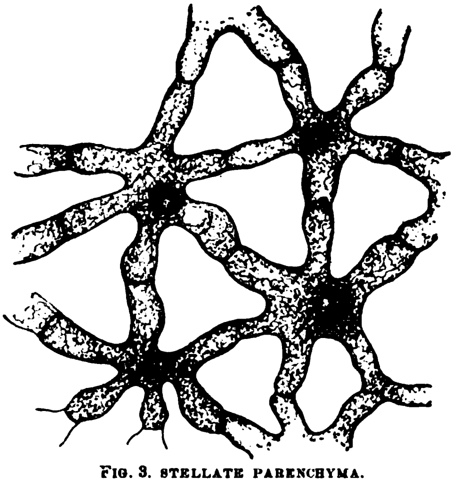


FIG. 3. STELLATE PARENCHYMA.
From stem of Juncus.

have all their walls cutinized. They constitute a tissue known as *cork* (Fig. 4).

(2) *Collenchyma* differs from parenchyma, of which it is hardly more than a variety, in the elongation of the cells, the absence of intercellular spaces, and the thickening of the angles of the cells where three or more walls join (Fig. 5). These thickened parts are more highly refractive than other parts of the wall, and have a very peculiar bluish-white lustre. Collenchyma occurs only in elongated organs (stems, petioles, etc.), where it forms a strengthening tissue beneath the epidermis.

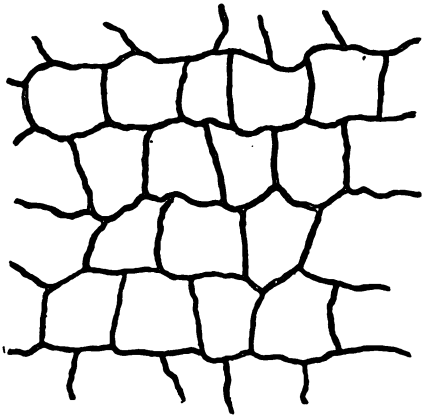


FIG. 4. CORK TISSUE.
Longitudinal section from bottle-cork.

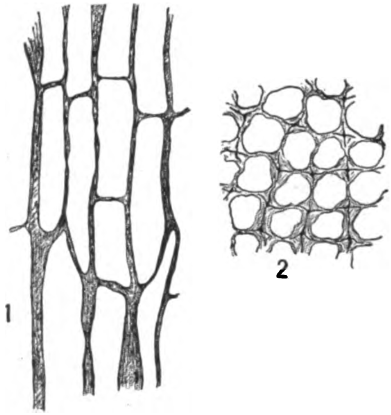


FIG. 5. COLLENCHYMA.
1, Longitudinal section; 2, transverse section.

(3) *Sclerenchyma* occurs in two forms, in one of which the cells have their three dimensions almost equal; in the other they are greatly elongated (Fig. 6). In both the wall is excessively thickened, sometimes so much so that the lumen is nearly obliterated. In all cases the protoplasm disappears at maturity, and the tissue is of use to the plant only by its mechanical strength. The short-celled sclerenchyma is common in the stone fruits (peach and cherry), in the shell of various nuts, in the gritty parts of the flesh of pears, quinces, etc., and in the hard portions of bark, many dry fruits, and seeds. Elongated sclerenchyma cells are most abundant in stems and leaves, in which they form continuous strands or bands, closely associated with the vascular bundles. They are often called bast-fibres, but do not always belong to the bast or phloem bundles. The individual cells taper at each end, the ends of adjacent cells above and below overlap, and thus give to the strands great flexibility and a tensile strength which in many cases exceeds that of the best steel. The cells are relatively very long, 1 to 4 millimeters in jute, 10 millimeters or more in hemp, 20 to 40 millimeters in flax, and as much as 220 millimeters in 'ramie,' with diameters from .01 to 0.4 millimeter. The strands of sclerenchyma fibres constitute the so-called fibres of commerce, the finer ones of which are used for textile fabrics and the coarser for cordage, etc.

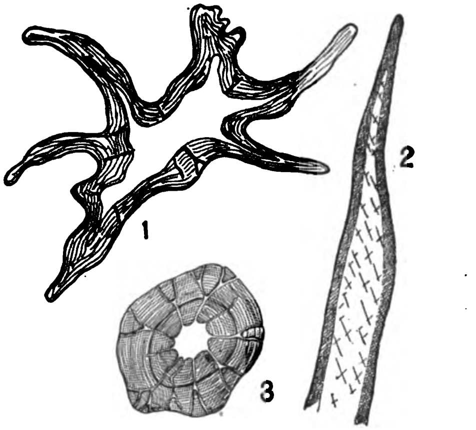


FIG. 6. SCLERENCHYMA.
1, Irregular form (idioblast) from leaf of tea; 2, surface view of a fibre showing tapering end and oblique pits; 3, transverse section of a fibre showing concentric structure of wall with pore-pits.

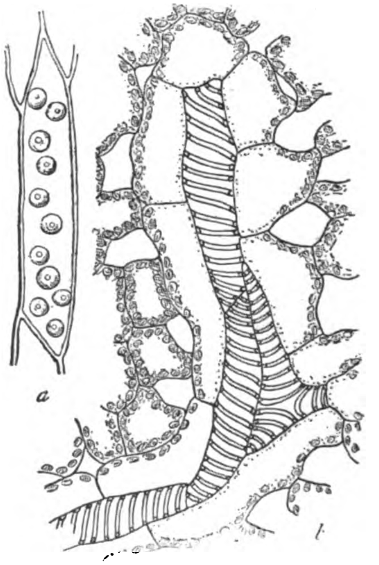


FIG. 7. TRACHEIDS.
a, from stem of pine; *b*, forming the termination of a xylem bundle in a leaf of *Impatiens parviflora*.

(4) *Tracheæ* and *tracheids*. Tracheids are usually elongated cells, whose walls have become lignified (by which they are made very pervious

to water) and thickened in spiral or annular lines or in reticulate patterns (Fig. 1). At maturity the protoplasm disappears, leaving only the cell-wall of service to the plants. Tracheæ are similar to tracheids in the sculpturing of their walls, but instead of being single cells they are formed by the fusion of a row of cells lying originally end to end, the end walls being resorbed as the lateral walls thicken and the protoplasm disappears. At maturity the long empty tubes thus formed show little trace of the cells from which they originated. In angiosperms they constitute the greater part of the xylem bundles, changing to tracheids as the bundles grow smaller and come to an end (Fig. 7*b*). But in gymnosperms (pines and their allies) tracheæ are formed only in the primary xylem, almost all the secondary xylem being tracheids with characteristic circular-bordered pits (Fig. 7*a*). Tracheæ and tracheids are the most efficient tissues for the transport of water in the larger plants.

(5) *Sieve tubes* are cell fusions formed by the partial resorption of the end walls of a row of young cells. The end partitions and sometimes the lateral walls which adjoin other sieve tubes become perforated, forming a so-called 'sieve plate,' through which the contents of the sieve tubes (a slimy mixture of soluble proteids, carbohydrates, and other foods) pass freely. Sieve tubes are found in the phloem bundles, in which they constitute the most efficient tissue for the transport of foods (Fig. 8).

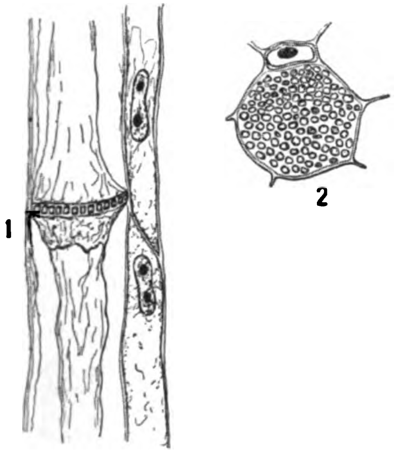


FIG. 8. SIEVE TUBE AND COMPANION CELL.
1, In longitudinal section; 2, in transverse section showing a sieve plate.

(6) *Latex tubes* are long, much-branched tubes, with free or anastomosing branches, which contain the milky or colored sap in certain plants. There are two sorts, articulated and non-articulated. A non-articulated tube arises by early differentiation of certain cells in the embryo, which push their way among the other developing tissues by independent growth. The articulated tubes arise by the fusion of rather indefinite rows of cells, either longitudinal or transverse, which form a network of irregular tubes. Latex tubes are found in the phloem bundles, or just outside these bundles in the cortex of stems, and accompany them into the leaves, where they ramify widely. Their terminals come into close relation with the nutritive cells. (See illustration under LATEX.) They seem to constitute a transportation system for foods. See GROWTH (in Plants); ANATOMY OF PLANTS; CELL (in Plants); ROOT; STEM; CONDUCTION; LATEX.

HISTOLOGICAL TECHNIQUE.

The methods of histological observation were at first extremely crude, consisting merely in tearing apart the tissues and examining them under the microscope. Such handling, of course, largely destroyed the relations of the different elements of the tissues to one another. The cutting of thin sections of tissue with a razor was soon introduced, this being much facilitated by the previous hardening of the tissues in some suitable solution. Such sections were, however, difficult to study, owing to their transparency and the fact that the different tissue elements possess nearly the same index of refraction. The staining of sections was the next great improvement in technique. At first a single stain was used, the denser elements taking a darker shade than those of less dense structure. The discovery of what is known as differential staining, whereby the different tissue elements are stained different colors, and the introduction of an instrument for section cutting, known as the microtome (see further below), together with improvements in the microscope, have been the main factors in the recent rapid development of the art. At present the most commonly used technical procedures in the examination of tissues and organs is as follows:

The first step is *fixation*. By this is meant a rapid killing of the tissue in such a way as to allow it to retain as nearly as possible the same form and relation as in the living tissue. Among the more common fixatives may be mentioned alcohol of various strengths, formalin in from 5 per cent. to 20 per cent. solutions, osmic acid, usually in 1 per cent. solution, Müller's fluid (2.5 grams of potassium bichromate and 1 gram of sodium sulphate, dissolved in 100 cubic centimeters of water), Fleming's fluid (a mixture of osmic, chromic, and acetic acids in water), chromacetic acid (1 per cent. solution in water), and corrosive sublimate in saturated aqueous solution. Many other fixatives are used for special purposes; thus, osmic acid is employed for the demonstration of fat and myelin. The small slices of tissue employed are allowed to remain from 12 to 48 hours in a large amount of fixative. Fixed tissues which have been fixed by any other agent than alcohol are then subjected to prolonged washing with running water. The next step is *hardening*. The fixing agents also act as hardening agents if allowed to act sufficiently long. Many fixatives, however, have a detrimental effect upon the tissues if their action is too prolonged. It is, therefore, quite common to transfer the tissues after proper fixation to some new fluid for the purpose of hardening and preservation. The almost universal hardening and preserving agent is alcohol, but formalin, too, in from 5 per cent. to 10 per cent. aqueous solution, is now extensively used. The first alcohol bath for plant tissues should be 35 per cent. or weaker, while many animal tissues will stand 50 per cent. This should be followed consecutively by 50 per cent., 70 per cent., 90 per cent., and 97 per cent. alcohol. For long preservation 80 per cent. alcohol is the most satisfactory. Next in the process is *imbedding*. By this is meant the impregnation of the tissues with a liquid which afterwards hardens, thus holding the tissues in a firm mass, which can be easily cut. For this purpose paraffin and celloidin are most commonly used. In paraffin imbedding, the tissue is first immersed in any pure solvent of paraffin, then passed to a warm solution of paraffin in the solvent, and finally left in pure melted paraffin, until thoroughly impregnated. In celloidin imbedding the tissue is transferred from alcohol to a mixture of alcohol and ether, and then placed in a solution of celloidin in a mixture of equal parts of alcohol and ether. After impregnation the paraffin is allowed to harden by cooling, or the celloidin to thicken by exposure to the air and consequent evaporation of the alcohol and ether, after which it is immersed in chloroform for hardening. The operator then proceeds to cut sections by means of the *microtome.* This instrument consists essentially of a knife-carrier, which can be made to slide back and forth past a clamp to which the specimen is attached. The imbedded specimen is fastened to a block, usually of wood, clamped in the microtome. The clamp is so arranged that the blocked specimen can be raised any desired fraction of a millimeter, thus bringing any thickness of it above the knife. In paraffin-cutting the knife is kept dry; in celloidin section-cutting it is kept flooded with alcohol. The sections are then stained for the purpose of bringing out sharply the different tissue elements. For staining the nuclei, carmine, hæmatoxylin, and various aniline dyes are commonly used. For demonstrating the other tissue elements other dyes may be used, eosin being much used. The procedure in staining celloidin sections with hæmatoxylin and eosin is as follows: The sections are first allowed to remain for several minutes in an aqueous solution of hæmatoxylin; then they are thoroughly washed with 97 per cent. alcohol, and placed for several minutes in an alcoholic solution of eosin; they are then again washed in alcohol and cleared in oil of origanum or bergamot containing a little eosin. From the clearing bath the specimen is lifted to a glass slide, the excess of oil is removed by means of blotting-paper, a drop of a solution of Canada balsam is placed upon the specimen, and the whole is covered with a thin glass, called the cover-glass. By the drying and hardening of the balsam a permanent 'mount' of the specimen is secured.

The above methods of procedure are illustrative of those applicable to general histological material. The examination of special tissues and organs requires the use of special methods of technique. This is especially true in regard to the nervous tissues, for the study of which some very elaborate methods have been devised, some of which will be found described in the article NERVOUS SYSTEM.

For histological methods as applied to plant tissues, consult Chamberlain, *Methods in Plant Histology* (Chicago, 1901); for methods in animal histology, consult Lee, *Microtomist's Vade-mecum* (London, 1890).

HISTORICAL ASSOCIATION, AMERICAN. A society of historical students and writers, founded at Saratoga, N. Y., in September, 1884, at the suggestion of Herbert B. Adams, of Johns Hopkins University. Its original membership was 40, but within a year it had increased to 250, and in 1889 it received a definite standing and recognition by an act of Congress incorporating it in the District of Columbia. The society has exerted wide influence in directing and stimulating historical research, and its publications and monographs have covered a broad field of historical study. Allied with the society is the American Society of Church History. This organization, founded in March, 1888, became the Church History Section of the Historical Society in 1889. Another important branch of the society is the Historical Manuscripts Commission, which prepares valuable manuscripts for publication. The society holds annual meetings, and publishes an annual report through the Smithsonian Institution at Washington. These reports include historical articles and bibliographies, and the society publishes in addition many monographs. As examples of the latter may be mentioned: *Federal Land Grants in the United States,* by George W. Knights; *Church and State in the United States,* by Philip Schaff; *Willem Usselinx,* by J. F. Jameson; *The Continental Congress,* by Herbert Friedenwald; and *The Study of History in Schools,* by a special committee of seven, appointed by the society. The presidents of the society have included eminent American historians. They have been: Andrew D. White, George Bancroft, Justin Winsor, William F. Poole, James Schouler, George F. Hoar, Edward Eggleston, and Alfred T. Mahan. The membership is about 1400.

HISTORICAL SOCIETY, ROYAL. A learned association in London, founded in 1868, and incorporated July 31, 1889, with the object of promoting the study of history. Its membership, which is international, numbers about 600, divided into Fellows, Honorary Fellows, and Corresponding Members. On May 2, 1896, the Royal Historical Society amalgamated with the Camden Society (q.v.). The Royal Society publishes annual volumes of Transactions and Documents, which are distributed without charge to members.

HISTORIC GEOLOGY. See GEOLOGY.

HISTORY (Lat. *historia,* Gk. *ἱστορία,* history, from *ἵστωρ, histōr,* learned, from *εἰδέναι, eidenai,* Skt. *vid,* OHG. *wizzan,* Ger. *wissen,* to know). A systematic narrative of past events, or, in the light of modern historical scholarship, the science of the progressive development of human society. The social and economic conditions of peoples, their racial affinities and physical environment, exercise determining influences upon their history, and find expression in their thought, their art, and their politics. History deals with the social structure in its successive forms and recognizes as inseparable allies all sciences which contribute to a knowledge of man as a social being, and in his relation with the physical world.

As a science, history is primarily inductive. It proceeds from a body of concrete facts, which critical study links together according to the sequences of time and causation. Afterwards deductive processes may be used, but always sparingly and cautiously.

Historical method comprises four processes: the collation of facts; the arrangement of these facts, according to the sequences of time and causation; criticism, by which the value of the facts is determined; and their interpretation in accordance with the results of arrangement and criticism. These processes are all simple; they are the ordinary processes of scientific research, but in carrying them out the human equation becomes so large an element of the problem as to make it essentially different from the problems of the physical world, and for this reason history can never be an exact science.

History depends upon human evidence, and its investigation must follow the laws governing the reception of human evidence. These are found to a considerable extent in the body of principles developed by jurisprudence for the reception of evidence in the courts. The historical material is contained in several categories: (a) Remains—such as buildings, walls, roads, statues, pictures, medals, coins, implements—whatever, indeed, man has made and used and which may thus throw light upon his civilization and his deeds. These may be studied directly, when accessible, or through the reproductions easily obtainable by means of modern processes.

(b) Documents. Under this head are included official and business papers and letters written with an immediate practical purpose.

(c) Literatures. This class includes a great body of material of the highest value—the writings through which are expressed the ideas of the peoples, their philosophy, poetry, science, and religion.

(d) Traditions. Much of this class is preserved in the literatures; much of it must be gathered from other sources.

(e) Laws. These, especially public law, are found in codes and treatises, and are of great value in determining many questions.

(f) Contemporary writings with historical purpose—annals, chronicles, biographies. Under these heads can be classified the original material on which secondary historical work, the written history of a nation or an age, is based and by examination of which its accuracy must be tested.

This material may also be divided into two great classes of evidence—conscious and unconscious. It will be seen that some of this material must have been prepared consciously to influence the opinion of contemporary or succeeding generations. In this class are proclamations, statements, writings, narratives, told with intention concerning events within the narrator's own knowledge, or reported to him by others. Such evidence must be taken with qualifications attaching to all ex-parte testimony. On the other hand, the evidence may be given unconsciously, as in documents of record, writings or other remains, prepared with no other purpose beyond that of direct utility. A striking example of this class of evidence is found in the little cylinders and tablets of clay, preserving in the business records, impressed upon them in cuneiform characters, so much of the social history of the Babylonians of thousands of years before the Christian Era. All these materials of human history must be subjected to searching inquiry as to their original purpose, and the circumstances under which they were made. The development of history into scientific form has been the work of ages, and owes its final impulse to the great improvements in methods in the physical sciences during the eighteenth and nineteenth centuries, although it developed along with the development of the human society whose life it records. The historical idea requires for its existence a background and a consciousness on the part of society of itself and of its continuity; of its relations to a past and a present. The growth of this social self-consciousness has been a matter of time. It is interesting to notice, on the other hand, how the study of their history has sometimes aroused in a people the consciousness of their own national life, which before was dormant. An example of this may be found in the Balkan States, which were roused not many years ago into determined revolt against Turkish rule by the teaching of their national history through the efforts of a few patriotic scholars.

The new outlook upon the natural world given by the physical sciences and the change in historical methods gave rise to a controversy in the last century, in which certain philosophical thinkers of the highest ability undertook to maintain that "human actions are governed by laws as fixed and regular as those which rule in the physical world." Auguste Comte, Henry Thomas Buckle, and Herbert Spencer are the distinguished sponsors of this theory. Buckle, in his *History of Civilization in England*, the first volume of which was published in 1857, elaborated this idea with a profundity of learning, but with much inconsistency of reasoning. Such literary historians as Charles Kingsley and James Anthony Froude entered the discussion on the other side, and John Stuart Mill, in his *System of Logic*, made a very sane and able contribution to it. The strongest and most extreme presentation of the opposite side of the controversy is, perhaps, that made by Froude in his lecture of 1864 on "The Science of History." He maintained with great eloquence that the determination of human movements upon any basis of scientific accuracy was impossible. This old controversy is closed now in the light of a better understanding of what the science and scientific method really are, but it is of interest historically as marking one stage in the development of the science of history.

The development of history down to the nineteenth century may be traced through the work of a very few writers and scholars. The first of all historians was the Greek Herodotus, who lived in the fifth century B.C. He was, however, only a narrative writer, recording with great accuracy those events which came within the scope of his personal knowledge, but mingling with his narratives much which came to him only by hearsay, and to which he applied no critical canons. Thucydides, the next of the great historians, is justly estimated as one of the greatest historians of all time. He recorded events with remarkable conciseness, and first applied philosophical reasoning to the historical narrative. Among narrative historians the accomplished Xenophon deserves a place. Polybius, with a wider outlook, followed in the footsteps of Thucydides. Of the Romans, Cæsar, Livy, and Tacitus show a high development of the historical sense, the two former confining themselves to the narrative field, and the last claiming a place in the class of historians like Thucydides, who endeavored to find the meaning of history beneath the mere sequence of events. The historians of the later Roman Empire were, for the most part, apologists for, or eulogists of, the emperors who were their masters, and establish no landmark of importance. During the Middle Ages there was no historical writing worthy of the name in Europe. The historical writing of the time is contained in the annals and chronicles preserved in the monasteries, which were very little more than diaries from day to day, kept without any discrimination by men whose outlook upon the world was of the narrowest. Einhard, in the reign of Charlemagne, Otto of Freising, in that of Frederick Barbarossa, and a few others, alone rise a little above the dead level, which offers material for historical research, but no true history. The awakening of a broader and more vigorous scholarship in the period of the Renaissance produced a new school of political and historical thinkers, who built upon the revived classical models. They are found in Italy, where Machiavelli and Guicciardini wrote historical works that are admirable in thought and style, and in France, Spain, and England, where the example of Italy was followed as in other fields of culture. In the eighteenth century the Englishman Gibbon, who devoted his life to his great work, *The Decline and Fall of the Roman Empire,* left one of the masterpieces of historical scholarship—a work that stands to-day as the most thorough and scholarly presentation of the history of the later Empire and of the Middle Ages. Voltaire, Hume, Montesquieu, and Robertson are brilliant names in the progress of historical thought of the same century. It remained, however, for the nineteenth century to develop history into a systematic science. With Niebuhr began a rational study of classical history, which has been carried on by Mommsen and Curtius for Roman and Greek history respectively. The greatest impulse, however, for the study came from the class-rooms of Leopold von Ranke (1795-1886). Ranke grasped the fundamental idea of historical science with a rugged sincerity, both of theory and practice, and impressed his spirit upon a large body of enthusiastic students in Germany and America. Waitz, Droysen, von Sybel, von Holst, Treitschke, and others have followed with greater or less ability along the path over which he led the way. In France within the last half century historical work and instruction have developed with great rapidity, and Monod, Duruy, Henri Martin, Lavisse, Rambaud, and many others have exemplified the French genius for clear and scientific thinking, and for condensed lucidity of statement. In less degree the other Continental countries have contributed to the development of the science. In England, along with such brilliant literary historians as Macaulay, Kingsley, and Froude, we have a body of eminent scientific scholars, of whom Freeman, Green, Stubbs, Creighton, and Gardiner are distinguished representatives. In America, whose scholars have drawn largely from the German and French schools, there has also been a noticeable development in historical writing and in critical scholarship. Succeeding the earlier school, which included Bancroft, Prescott, and Motley, there has grown up in the United States a modern school, trained in the best university methods of research, and enrolling in different kinds of historical work hundreds of vigorous and enthusiastic scholars. Francis Parkman, Justin Winsor, and John Fiske left behind them a body of historical writings of a very high order. Henry Adams, James Schouler, Captain Mahan, John Bach McMaster, and James Ford Rhodes are contemporary American historians whose studies in the history of their own country are of permanent value, and many more names might be added. From the lecture rooms and seminaries of Europe and America a constant impulse to wise and thorough study and use of historical material goes forth from earnest and able teachers. Numerous periodicals are devoted to the advancement of historical research. Most noteworthy of these are the *Historische Zeitschrift* in Germany, the *Revue Historique* in France, the *English Historical Review* in England, and the *American Historical Review* in the United States.

It is the tendency of the modern school of historical students to rely more upon the thorough study of true sources of history, rejecting the myths, traditions, and second-hand accounts, which have so often formed much of the material of writers of so-called history. Collections of written sources form a very considerable part of the historical publications of to-day, and guides and commentaries to these collections of sources are constantly being issued to enable the student to find his way intelligently through the mass of material which the source collections present. In this direction Germany, under the leadership of Ranke, led the way. The massive and constantly growing collection of sources of German history, known as the "Monumenta Germaniæ Historica," is in itself a monument of scholarship and research, and in France, England, and the United States similar collections have been published, and are in process of publication from year to year. The well-known Rolls Series in England is nearly as notable a collection as the German *Monumenta.* Even in historical instruction in the schools, the simpler and more interesting sources have been put in available form for elementary students, and are used with great success to enliven the historical narrative, and to give an appreciation of the true nature of historical research. This tendency to explore the actual evidence critically has done much to clear history of the fables, myths, and traditions which made much of it unreliable, and to render it real to the student.

DIVISIONS OF HISTORY. History is commonly divided chronologically into three great periods—Ancient, Mediæval, and Modern. While there is complete continuity in the course of history, each one of these periods has certain characteristics distinguishing it from the others, and making it convenient to treat each as a unit. In the first period the beginning and growth and decline of the great civilizations of antiquity are comprised. Here are considered the old East, Egypt, Mesopotamia, and Syria, Greece, and Rome. In these remote ages were laid the foundations of civilization, the elements of which were handed on from the valleys of the Nile and Euphrates to the Greeks and Romans, who fashioned them into instruments available for later generations. The Roman Empire welded together all the diverse elements of the ancient world. Ancient history is usually regarded as ending when the irruption of the Germanic barbarians from Northern and Central Europe into the highly developed Roman civilization caused the downfall of the old Empire in the fifth century of our era, and ushered in several centuries of confusion. The world that had been so thoroughly organized by the Roman was materially modified in its structure by the individualism for which the German stood, in contradistinction to the principle of imperial unity emphasized in the Roman world. Out of this stormy mingling of conflicting ideas in the Middle Ages came modern Europe, which rests politically upon a combination of the German and Roman principles. The Middle Age is regarded as closing about the end of the fifteenth century, when the fall of Constantinople had removed the last shadow of the old Roman world, when the discoveries of Columbus had immeasurably widened the European horizon, and the revolt was beginning against ecclesiastical imperialism. The national idea slowly took form out of the feudalism of the Middle Ages, and modern nations gradually arose, with the result of bringing into being a legal code for the regulation of international relations. The internal confusion of the Middle Ages had separated Europe from the rest of the world, but with the revival of learning and the interest in new things, known in history as the Renaissance, came a larger acquaintance with that older world of the East which, while less progressive, had its own civilization, institutions, and history. The conflict of the religions and civilizations of the East and West produced the Eastern question, in which are contained so many of the most difficult problems of modern international politics. The opening of the New World in the period of discovery introduced a new factor of the greatest importance in the world's history—the future great power of the Western Hemisphere, which had as its heritage the civilization of Europe, but was unhampered by immemorial traditions and institutions, and by conflicting national interests. The same pregnant era that saw these new elements thrown into the world's life saw also the renewal of the old conflict between the German idea of liberty and the Roman idea of unity in the Protestant revolt against the control of the Roman Church. This conflict shaped much of the world's history for three centuries. The expansion of population in the older countries, the development of commerce, the increasing knowledge of the world, and the growing ambition of nations conscious of their own possibilities and increasing rapidly in power and wealth, together with the religious persecutions generated by the Protestant revolution, brought about the opening and settlement of new and hitherto inaccessible regions, resulting in the widening of national interests, enormous increase in the power and resources of the great nations, and a development of national rivalries on a scale hitherto unknown. There has also come an insistence on the part of civilized peoples that barbarian races shall submit to civilization and not obstruct the progress of world development. History has until recently concerned itself almost exclusively with the Occidental nations, regarding the Orient only as it has come in contact with the West. Now, however, the histories of India, China, Japan, and all other peoples that have enjoyed organized life have assumed importance in view of their bearing upon the larger problems of the age. Such has been the movement of the great current of history which has expanded in volume with the expansion of the race. Within these wide boundaries the histories of different countries may be studied in detail; and the study of history may be still further specialized along the lines of social, economic, political, or constitutional fields, or in those of art, literature, or thought. These special fields become increasingly important as history grows in complexity, so that light is needed upon its phases in detail.

The true spirit of history is nowhere better expressed than in Ralph Waldo Emerson's essay on *History*. See also Frederic Harrison, *The Meaning of History* (London, 1894); Lord Acton's inaugural address as regius professor at Oxford (London, 1895); W. S. Lilly, "The New Spirit in History," in *Nineteenth Century* (October, 1895); White, "The Study of History," *Atlantic Monthly* (January, 1870); Freeman, *Methods of Historical Study* (London, 1886); Droysen, *Grundriss der Historik*, trans. by Andrews as *Outlines of the Principles of History* (Boston, 1893); Adams, *Manual of Historical Literature* (3d ed., New York, 1889); Bernheim, *Lehrbuch der historischen Methode* (Leipzig, 1894); Langlois and Seignobos, *Introduction to the Study of History*, trans. from the French by G. G. Berry (New York, 1898); Froude, *Short Studies on Great Subjects* (New York, 1893). On the pedagogical aspects of the subject, see Hall (ed.), *Methods of Teaching History* (Boston, 1883-85), a collection of papers by well-known educators: Channing and Hart, *Guide to the Study of American History* (Boston, 1896), very full bibliographies; Committee of Seven of the American Historical Association, *The Study of History in Schools* (New York, 1899); publications of the New England History Teachers' Association. The publications of the American Historical Association contain many papers relating to history in general in its different aspects.

HIS'TRIOMAS'TIX (Neo-Lat., from Lat. *histrio*, actor + Gk. *μάστιξ*, *mastix*, scourge). A comedy produced not later than 1599, of which John Marston was at least a collaborator, and printed in 1610.

HISTRIOMASTIX, THE PLAYER'S SCOURGE, OR ACTOR'S TRAGÆDIE. A tract violently attacking the drama, by William Prynne, a Puritan, published in 1632. It gave great offense, and the author was fined, deprived of his Oxford degree, and, losing both his ears, was sentenced to life imprisonment.

HIT (Gk. Ἶς, *Is*). A town of Asiatic Turkey, situated among deserts and salt marshes on the right bank of the Euphrates, in the Vilayet of Bagdad, and 110 miles west-northwest of the city of that name (Map: Turkey in Asia, K 6). It is remarkable for the asphalt and naphtha pits in the neighborhood, from which asphalt is believed to have been obtained for the construction of the walls of Babylon. At present the chief products of the place are asphalt, naphtha, salt, and lime. Population, about 5000.

HITA, ē'tȧ, GINES PEREZ DE. See PEREZ DE HITA, GINES.

HITCH. See KNOTTING AND SPLICING.

HITCH'COCK, CHARLES HENRY (1836—). An American geologist, the son of Edward Hitchcock. He was born at Amherst, Mass. After graduating at Amherst College (1856), he was assistant to the Geological Survey of Vermont (1857-61); State Geologist of Maine (1861-62), and of New Hampshire (1868-78). His report on his work in New Hampshire, containing a folio atlas of maps, profiles, and sections, is considered his most important publication. Incidental to the survey was the maintenance of a meteorological station throughout the year on the summit of Mount Washington, whence daily statements of the weather conditions were issued before the United States Signal Service had begun its weather predictions. Hitchcock's publications comprise more than one hundred and fifty papers, chiefly concerning New England geology, crystalline schists, and ichnology. He was appointed professor of geology at Dartmouth College in 1869, and in 1883 was vice-president of the American Association for the Advancement of Science. He was a member of the Imperial Geological Institution of Vienna, and was one of the original and most active members of the Geological Society of America. He was the first to suggest the locality of the great terminal glacier in the United States.

HITCHCOCK, Edward (1793-1864). A scientist and educator who contributed greatly to the development and popularizing of geological science in America. He was born in Deerfield, Mass., where for a time he served as principal of the academy. From 1814 to 1818 he published the *Country Almanac*, and in the latter year entered Yale Theological Seminary, from which he was graduated in 1820. After serving as pastor of the Congregational Church in Conway, Mass., he was appointed professor of chemistry and natural history in Amherst College. As president of that institution from 1845 to 1854 he improved its financial condition, and greatly extended its usefulness. When he resigned the presidency, he retained the professorship of natural theology and geology, holding this office until his death. Throughout the latter part of his life he devoted much time to geological research. In 1830 he was appointed State Geologist of Massachusetts, and under his direction the first geological survey of any extensive area was completed. The results of this work were published by the State Government in several voluminous reports. In 1836 he received the appointment of geologist of New York, but resigned the position. He served as geologist of Vermont from 1857 to 1861, and in 1850 was commissioned by the State of Massachusetts to examine the agricultural schools of Europe. He was one of the founders of the Massachusetts Agricultural College, and of Mount Holyoke Seminary, and was the first president of the American Geological Society. His extensive collection of fossil footprints of the Connecticut Valley was presented to Amherst College. The most important of his works are: *Economical Geology* (1832); *Report on the Geology, Mineralogy, Botany, and Zoölogy of Massachusetts* (1833); *Elementary Geology* (1840); *Geology of Massachusetts* (1841); *History of a Zoölogical Temperance Convention in Central Africa* (1850); *Religious Lectures on Peculiar Phenomena of the Four Seasons* (1850); *Religion of Geology and Its Connected Sciences* (1851); *Religious Truth, Illustrated from Science* (1857); *Ichnology of New England* (1858); *Report on the Geology of Vermont* (1861); and *Reminiscences of Amherst College* (1863).

HITCHCOCK, Ethan Allen (1798-1870). An American soldier and mystic. He was a grandson of Ethan Allen, was born at Vergennes, Vt., and was educated at West Point. After garrison service, he was instructor in tactics at West Point (1824-27), and commandant there (1827-29). He served against the Indians in Florida in 1836 and 1840, and in the last campaign of the Mexican War. For his service in Mexico he was brevetted brigadier-general (1847). He commanded the Pacific Division from 1851 to 1854, and in the next year resigned because of a quarrel with Jefferson Davis, then Secretary of War. At the outbreak of the Civil War he was appointed major-general, and served at first on special duty under the Secretary of War, and later as commissioner of exchange. He was also confidential adviser to the President. Hitchcock was a mystic, and wrote: *Remarks upon Alchemy and the Alchemists*, arguing that they were religious philosophers, and that truth was the philosopher's stone (1857); *Swedenborg, a Hermetic Philosopher* (1858); *Christ, the Spirit*, in which the Gospels are treated as symbolical writings of the Essenes (1860); *Red Book of Appin, and Other Fairy Tales* (1863); *Remarks on the Sonnets of Shakespeare* (1865 and 1867); *Spenser's Colin Clout Explained* (1865); and *Notes on the Vita Nuova of Dante* (1866), in all of which he gives hermetic explanations of the matter of these books.

HITCHCOCK, Ethan Allen (1835—). An American politician, born in Mobile. For several years he was in business in Saint Louis. In 1897 he was sent as United States Minister to Russia, and subsequently was made Ambassador upon a corresponding change in the Russian diplomatic service. In 1898, upon the retirement of Cornelius M. Bliss, he was appointed Secretary of the Interior. He entered upon the office in 1899. —His brother Henry (1829-1902) was born near Mobile, Ala., and was one of the foremost lawyers and citizens of Saint Louis.

HITCHCOCK, Roswell Dwight (1817-87). An American clergyman and educator, born in East Machias, Me. He graduated at Amherst College in 1836, and at Andover Theological Seminary in 1838, and studied at the universities of Halle and Berlin in 1847. After his graduation from the theological school he was a tutor at Amherst until 1842. He preached a year in Waterville, Me., and in 1845 was installed over the First Congregational Church in Exeter, N. H. He resigned in 1852 to accept the professorship of revealed religion at Bowdoin College. Three years later he resigned at Bowdoin to become professor of Church history at Union Theological Seminary, of which he was elected president in 1880. He was on the editorial staff of the *American Theological Review* for seven years, traveled in Egypt and Palestine, and was elected president of the Palestine Exploration Society in 1871, and vice-president of the American Geological Society in 1880. He published: *The Life, Character, and Writings of Edward Robinson* (1863); *Complete Analysis of the Holy Bible* (1869); *Socialism* (1879); *Carmina Sanctorum*, with Dr. Zachary Eddy and Rev. Lewis W. Mudge (1885). A collection of sermons, *Eternal Atonement*, was published posthumously (1888).

HITCHIN, hĭch'ĭn. A town in Hertfordshire, England, 14 miles northwest of Hertford (Map: England, F 5). It was the original seat of Girton College; it has a free school, founded 1622; and its fine old parish church contains an historical crypt, interesting monuments, and an "Adoration of the Magi" by Rubens. Hitchin has large breweries, and a trade in corn, malt, and flour. Straw-plaiting is carried on, and the cultivation of lavender for its essential oil, extensively used in perfumery, dates from 1568. Hitchin is recorded in the Domesday Book. It was given to Harold by Edward the Confessor, and came into the possession of William the Conqueror. Population, in 1891, 8860; in 1901, 10,072.

HITOPADESA, hê-tō̆'pȧ-dā̆'shȧ (Skt., salutary instruction), or BOOK OF GOOD COUNSEL. The name of a celebrated Sanskrit collection of fables, the contents of which have passed into almost all the civilized literatures of the world. The collection itself, in the form in which we possess it, is founded on older works of a kindred nature; and its preface expressly mentions 'the *Panchatantra* and another work.' For a convenient list of editions and translations and a sketch of the subject, consult Lanman, *Sanskrit Reader* (Boston, 1884). Two good editions with English notes are published in India by Peterson (Bombay, 1895); and by Godabole and Parab (ib., 1896). See PANCATANTRA; SANSKRIT LITERATURE.

HITTEREN, hĕt'tẽr-en. An island off the west coast of Norway, situated at the entrance to the Throndhjemsfiord (Map: Norway, C 5). It covers an area of nearly 200 square miles (including some adjacent islets), and has a population of about 3000. It is covered with low but rugged hills, reaching 1000 feet, among which are numerous lakes and streams. The inhabitants are mostly engaged in fishing.

HIT'TITES. A name that properly designates a rather promiscuous group of nations whose settlements extended from the westerly portions of Asia Minor to Armenia, northward close to the Caspian Sea, and southward to the watershed between the Euphrates and the Orontes. Besides this we also find references in the Old Testament to Hittites in Southern Palestine around Hebron (Gen. xxiii.), and Hittites are likewise frequently mentioned among the pre-Israelitish inhabitants of Palestine, and alongside the Canaanites, Amorites, Hivites, Perizzites, and Girgashites. It is quite impossible, however, to determine absolutely whether the same group (or subdivision of the same group) is intended in all cases. The indications are in favor of separating the Hittites of Central Palestine from those in the south and from the Hittites of Northern Syria and Asia Minor. The geographical nomenclature of the Old Testament is frequently vague, and Hittite is a term which is variously used by different writers. So far as the Hittites, whom tradition places around Hebron, are concerned, we are limited in our knowledge to the account of Abraham's purchase of the field of Machpelah from the sons of Heth (Gen. xxiii.), and to incidental references, such as Gen. xxvi. 34, which point to scattered Hittite settlements as far south as Gerar and Beersheba. They are on friendly terms with Edomites and Hebrews, but there is nothing to indicate their ethnic relationship to those two groups. Equally unsatisfactory is our knowledge of the Hittites of Central Palestine. We encounter them merely as one in the confederated group of pre-Israelitish inhabitants of Canaan proper, and considering the uncertain character of Hebrew traditions when it comes to specific names of peoples, there is no special value to be attached to this grouping. When we reach the days of David we find ourselves on safer historical ground. The presence of Uriah the Hittite (husband of Bathsheba) in the army of David (II. Sam. xxiii. 39) is a valuable indication that at this period a group known as the Hittites was still recognized, and there is no valid objection against regarding these Hittites as descendants of those whom tradition places around Hebron, which, it will be recalled, is also the centre of David's political activity. In Solomon's days (I. Kings xi. 1) we learn of alliances with Hittites, and here at last we have the Hittites of the north whose historical importance far outranks those of the south. The 'kings of the Hittites' to whom the writer in II. Kings vii. 6 refers are powerful rulers who as early as 1600 B.C. had established themselves on the Orontes, and whom the Egyptians, when under Thothmes I. they began their series of Asiatic campaigns, found to be most formidable enemies. While obliged to submit to Egypt for a while, the Hittites maintained a spirit of independence, and centuries afterwards the Babylonians and Assyrians were checked in their advance toward the west by the Hittites gathered at Carchemish, Kadesh, Marash, Hamath, and elsewhere. It is not until the days of Sargon II. (B.C. 721-705) that these Hittites along the Orontes are finally subdued and disappear from the horizon of history. Hittites, however, are not limited to Northern Syria. Monuments have been found in Cappadocia, Paphlagonia, Lycaonia, and Phrygia which by their general art, costumes of the personages sculptured on them, and above all by the character of the inscriptions accompanying the monuments, are identical with numerous Hittite remains found at Carchemish, Marash, and Hamath. It is the existence of these monuments spread over so large a district that enables us to form an idea of the important part played in ancient history by the Hittites. The inscriptions themselves have not yet been fully deciphered, but a beginning has been made, and enough is now known to warrant the assumption that between c.1200 and 800 B.C. Hittites formed the controlling element in Central and Western Asia Minor; and it also appears quite certain that the spread was gradual from the region of Cilicia to the north, northeast, northwest, and west. These Hittites appear to have been of a mixed ethnic type, of Turanian and Semitic elements, with a general tendency toward the prevalence of the Semitic over the non-Semitic.

According to Jensen, indeed, the Hittite language is Aryan in character; but this view is open to serious objections, and it is more likely that the Hittite language will be found to be affiliated with the Semitic stock. There is also a possibility of a direct connection between Hittite characters and Egyptian hieroglyphics, though it is not possible to speak with certainty on this and numerous other points connected with the Hittites. Further researches and explorations in Hittite districts are needed, and above all the discovery of a key that will enable scholars satisfactorily to interpret the inscriptions. The Hittite script, it may be added, is partly pictorial and partly syllabic. By virtue of its pictorial character it is possible to determine the general meaning of a Hittite inscription much more readily than to determine how it is to be read.

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HITTORF, é'tôrf', JACQUES IGNACE (1792-1867). A French architect, born in Cologne. He went to Paris in 1810 to study art, and from 1819 to 1830 was architect to the King. He was long engaged in the construction of public buildings, and at the embellishment of such public places as the Bois de Boulogne and the Champs Elysées. His chief work is the Church of Saint Vincent de Paul, in Paris. He published: *Architecture antique de la Sicile* (1826-30); *Architecture moderne de la Sicile* (1826-35); *Architecture polychrome chez les Grecs* (1851), all of which are still considered valuable contributions to the literature of architecture.

HITTORF, hĭt'tôrf, JOHANN WILHELM (1824—). A German physicist, born at Bonn. He has been since 1852 professor of chemistry and physics at Münster. Hittorf's earliest important researches were in electrolysis, and he was able to extend Faraday's work, his method of determining the mobility of ions being of the greatest importance to physical chemistry. In addition to his work in electrolysis, Hittorf made elaborate investigations of the various phenomena attending the passage of electricity through gases. In 1862 with Plücker he discovered that different spectra could be obtained from the same substances under different conditions of temperature. Later (1869), in studying the passage of electricity through tubes containing a rarefied gas, he observed that by increasing the exhaustion of the tube the dark space between the negative pole and the negative glow became wider, and that when the discharge from the cathode struck against the glass considerable fluorescence was produced. Hittorf also ascertained that these rays could be deflected by a magnet, and anticipated Crookes, who in 1878 published his famous researches with the vacuum or Crookes tubes and named the rays thus produced radiant matter. He investigated the allotropic occurrence of selenium and phosphorus, and in the case of the latter substance he was successful in producing a crystallized form, black in color and with a metallic lustre. Hittorf's many valuable papers on physics and chemistry are to be found for the most part in Poggendorff's and Wiedemann's *Annalen der Physik* (Leipzig, current).

HITZIG, hĭts'ĭk, EDUARD (1838—). A German alienist, grandson of the biographer and jurist Julius Eduard Hitzig. He was born in Berlin, studied medicine there and in Würzburg, and in 1875 became professor of psychiatry at Zurich. Four years afterwards he became professor in Halle, where he established an independent clinic for nervous and mental disorders, the first in Prussia. He wrote: *Untersuchungen über das Gehirn* (1874), the result of long research on cerebral physiology and pathology, and especially on localization of the various functions; *Ueber traumatische Tabes* (1894); and *Der Querulantenwahnsinn* (1895).

HITZIG, FERDINAND (1807-75). A German biblical scholar. He was born June 23, 1807, at Hauingen, Baden, and educated at Heidelberg, Halle, and Göttingen. In 1833 he was called to Zurich as professor of theology, with a special view to the exegesis of the Old Testament; but his lectures embraced also the New Testament and the languages of the East. In 1861 Hitzig returned to Heidelberg as professor. The first work which established his fame was his *Der Prophet Jesaia übersetzt und ausgelegt* (1833). Besides a translation of the Psalms, with a commentary (1835-36), he furnished for the *Exegetisches Handbuch zum alten Testament* the commentaries on the minor prophets (1838), on Jeremiah (1841), Ezekiel (1847), Ecclesiastes (1847), Daniel (1850), and the Song of Solomon (1855), with a translation of all the prophetical books as a supplement (1854). He died at Heidelberg, January 22, 1875. For his biography, consult Steiner (Zurich, 1882).

HITZIG, JULIUS EDUARD (1780-1849). A German criminal jurist and biographer. He was born in Berlin, studied law at Halle and Erlangen, and from 1799 to 1835 was connected more or less closely with the criminal courts of Warsaw and Berlin. To this period belong the *Zeitschrift für die preussische Kriminalrechtspflege* (1825) and *Annalen für deutsche und ausländische Kriminalrechtspflege* (1828), both founded by him. At Warsaw he had been intimate with the poets Mnioch and Werner, and in Berlin he was even more prominent in literary circles as founder of the 'Mittwochsgesellschaft,' a literary club. Hitzig was editor of the *Pressezeitung* (1840-44), and author of biographies of Werner (1823), of Hoffmann (1823, 3d ed. 1839), and of Chamisso (1839-40). With Häring, in 1842, he began to publish *Der neue Pitaval;* in 1826 he had brought out *Gelehrtes Berlin im Jahre 1825*.

HIVE-BEE. The honey-bee. See BEE.

HIVES. A name popularly given to the eruption known as urticaria or nettle-rash (q.v.). The eruption appears as white rounded elevations or long wheals, which turn red later, especially after scratching or rubbing, for the prurigo is intense. The use of lobsters or crabs has caused hives in some people. Certain drugs, such as the balsams, often cause it. After unloading the bowels, local treatment with dilute acids or bichloride of mercury will give relief. Alkalies and salicylates, taken internally, cut an attack short.

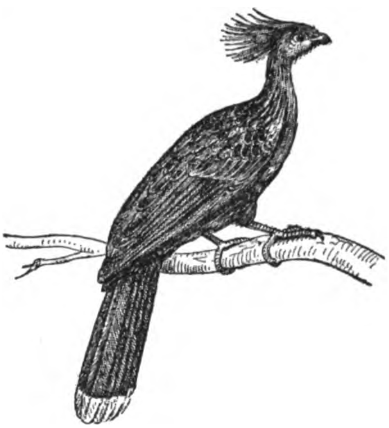
HIVE SYRUP, *Syrupus Scillæ compositus*. The compound syrup of squills, a plant growing on the northern coast of the Mediterranean Sea. The bulb is the officinal portion. It is generally dried for use, but is sometimes imported packed in sand, in a partially undried state. The syrup is prepared usually by taking of squill a moderately coarse powder; senega, a moderately fine powder; tartrate of antimony and potassa; sugar; diluted alcohol; and water. The whole is carefully mixed according to formulæ laid down in the Pharmacopœia. In its action it is an emetic, and combines the virtues of senega, squill, and tartar emetic, of the last of which it contains but one grain to the fluid ounce. It is also diaphoretic, expectorant, and in large doses cathartic. It was originally devised for the treatment of spasmodic croup and hives, whence comes its popular name. Great care must be taken, in employing it, not to allow its sedative operation to proceed too far. In overdoses it has been known to produce a fatal inflammation of the stomach and bowels, since tartar emetic is highly poisonous.

HI′VITES (probably connected with Ar. *ḥayy*, family, or Heb. *Ḥawwah*, Eve, or else from *ḥawwah*, serpent, in allusion to the clan-totem). One of the peoples driven out of Palestine by the Hebrews (Ex. iii. 8 et al.) and placed in the list (Gen. x. 17) among the sons of Canaan. Several of the biblical passages in which Hivites are mentioned present an uncertain text, as e.g. Joshua ix. 7, xi. 3; II. Sam. xxiv. 7. Hebrew writers seem to have confused Hivites, Horites (q.v.), and Hittites (q.v.), so that we cannot be quite certain even whether such a people as the Hivites ever existed.

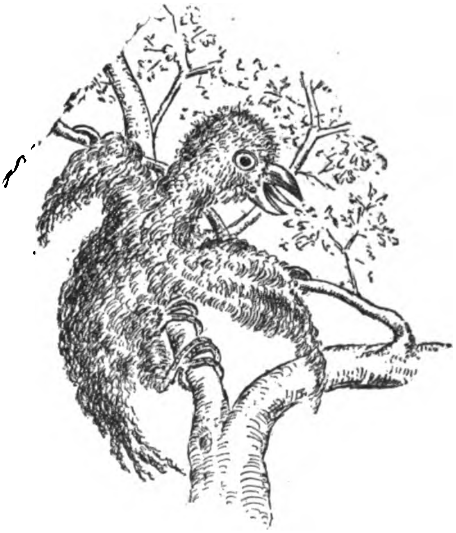
HIZEN, hē′*zen*. One of the nine provinces of the island of Kiushiu, Japan, famous in history and for its kaolin and the production of porcelain. It is rich in tea, tobacco, vegetable wax, and coal, but not in cereals, though in quality its rice is reckoned the best. Its chief towns are Saga and Nagasaki (q.v.). Arita and Imari, both situated in this province, are famed for their ceramic ware. It was formerly divided among ten daimios (q.v.). It is now mostly within the Nagasaki ken. Consult: Rein, *Japan* (London, 1884), and for the ceramic industries of the province, Brinkley, *Japan: Its History, Arts, and Literature*, vol. viii. (Boston, 1901-02).

HJÄRNE, yär′*ne*, HARALD GABRIEL (1848—). A Swedish historian, born at Klastorp. He was educated at Upsala, where he became docent (1872) and professor (1889). His studies on the relations between Russia and Sweden are of particular importance. He wrote: *Polens nordiska politik närmast före kongressen i Stettin 1570* (1884); *De äldsta svensk-ryska legationsakterna* (1884); *Från Moskva till Petersburg*, a sketch of Russian civilization (1888-89); *Unionsfrågan* (1892); *Sveriges statsskick under reformationstiden 1520-1611* (1893); *Medeltidens statsskick* (1895); and *Svensk-ryska förhandlingar 1564-72* (1897).

HOACTZIN, hō-ăkt′sĭn (South American name), or HANNA. A bird (*Opisthocomus cristatus*) of Guiana and Brazil, possessing many conflicting characteristics of structure, so that its place in classification has been greatly in dispute. Some writers have regarded it as nearly related to the plantain-eaters; others to the curassows. Most recent writers have placed it with or very near the Gallinæ, but generally as a separate order, the Opisthocomi. It has the general shape of a curassow, but in size is much smaller; is olive-color, varied with white above and deep bay below; and has a long pendent crest of loose yellow feathers. The tail is long and broadly tipped with yellow. It lives in bands in the forest, frequents the borders of streams, feeds upon leaves and fruits, rarely leaving the lower trees and bushes, flying weakly, and uttering a 'sharp grating hiss' as a call note. It feeds largely on a species of arum, which gives its flesh and whole body a vile musky odor, so that it is known in British Guiana as 'stink-bird.' On the Amazon it is called *cigano*, or 'gypsy.' Its nest is rudely built of sticks on some low bush, and the eggs, three or four in number, are whitish with reddish-brown blotches. The character and actions of the young are, however, the most remarkable thing about this extraordinary bird. They are hatched naked, and possess at birth well-developed claws on both the index (forefinger) and pollex (thumb) digits of the fore limb. Soon after hatching, the nestlings begin to crawl about by hooking these claws about twigs or any object accessible, and so use their wings precisely as feet, holding on also by the bill. This is an interesting reminder of the condition of the wing in the most ancient of birds (see ARCHÆOPTERYX), which used its anterior digits in much the same way. The young hoactzin, however, sheds its claws after a few days. Consult Newton, *Dictionary of Birds* (London and New York, 1896), where many further references are given.



THE HOACTZIN.



YOUNG HOACTZIN.
Showing hand-like use of immature wings.

HOADLEY, hŏd'lĭ, George (1826-1902). An American lawyer, and Governor of Ohio, born in New Haven, Conn. He was educated in the public schools of Cleveland, where his father had settled in 1830, and at Western Reserve College, then at Hudson, Ohio, where he graduated in 1844. He studied law at the Harvard Law School, was admitted to the bar in 1847, and two years later became a partner in the law firm of Chase & Bull at Cincinnati, in which Salmon P. Chase was the senior member. In 1851 he was chosen by the Legislature judge of the Superior Court of Cincinnati; in 1855 became city solicitor; and in 1859, upon the reorganization of the Superior Court, was elected judge, and was reelected in 1864. Originally a Democrat, he took a prominent part in the 'Barnburner' movement, was a War Democrat, and finally during the war allied himself with the Republican Party. He resigned from the bench in 1866 to resume his law practice. In 1872 he was active in the Liberal Republican revolt, but dissatisfaction with the nomination of Greeley caused him to remain in the party. In 1876, however, he allied himself with the Democratic Party on the tariff issue, and was one of the counsel for Tilden before the Electoral Commission. In 1883 he was the party's candidate for Governor of Ohio, being elected over Joseph B. Foraker by 12,000. Two years later he was in turn defeated by Foraker for reëlection to the same office. From 1887 until his death he practiced law in New York City.

HOADLY, Benjamin (1676-1761). A Church of England prelate. He was born at Westerham, Kent, November 14, 1676. He graduated B.A. at Cambridge 1696, became preacher in London in 1701, Bishop of Bangor in 1715, of Hereford in 1721, of Salisbury in 1723, and of Winchester in 1734. He attracted attention by controversies with the Nonconformists, and with the High-Church Party of the Church of England. His principles were developed in his *Essay on the Origin of Civil Government* (1709). The accession of George I. in 1714 brought Hoadly's views into favor with the Court, and he received advancement. In 1717 the so-called *Bangorian Controversy* arose. It began by Hoadly's publication of his views on the text, "My kingdom is not of this world;" in regard to which he maintained that Christ had left behind Him no such authority as that claimed by churches, and that this was the best way of answering the pretensions of the Church of Rome. These views gave great offense both to High Church and Dissenters. He was attacked from all quarters, and the controversy raged for three years. He died at Chelsea, London, April 17, 1761. His works were published with a life by his son, John Hoadly (London, 1773).

HOANG-HO, HWANG-HO, hwäng'hŏ', or Yellow River. Next to the Yang-tse-kiang, the largest river of China. It rises in a marshy plain in the District of Kuku-nor, Tibet, west of Lake Charing-nor and only a short distance north of the upper course of the Yang-tse-kiang. Its course is exceptionally tortuous. After flowing eastward to near the boundary of Tibet, it changes its direction first to the northwest and then to the northeast, in which latter direction it flows through the Chinese Province of Kan-su. Leaving the Province of Kan-su, it crosses the Great Wall into Mongolia. There it flows at first northeast and then east as far as the western boundary of the Chinese Province of Shan-si, where it turns sharply to the south, and, passing the Great Wall again, flows between the provinces of Shen-si and Shan-si, forming their boundary line. At about latitude 35° N. it turns sharply east, which direction it maintains as far as the city of K'ai-fung, in the Province of Ho-nan. From that point it flows in a northeastern direction until it falls into the Gulf of Pe-chi-li about latitude 38° N. Its total length is probably over 2500 miles, and its basin is estimated at 400,000 square miles. The chief tributaries of the Hoang-ho are the Tao-ho from the south, the Wei-ho from the west, and the Ta-tung-ho from the north. The Hoang-ho is navigable for small vessels for a short distance from its mouth and in some parts of its middle course. The course of the river has changed repeatedly, and the present mouth was that of the Ta-tsin until 1853. Prior to that time the course of the river below K'ai-fung was southeasterly, and its mouth in the Province of Kiang-su in about latitude 34° N. The sediment which is transported in large quantities by the Hoang-ho raises its bed, thereby causing inundations. These have been so frequent and so disastrous that the river has come to be known as 'China's sorrow.' In order to guard against the inundations, a vast system of dams and dikes has been maintained from time immemorial.

HOAR, hŏr, Ebenezer Rockwood (1816-95). An American jurist. He was born at Concord, Mass., the son of Samuel Hoar, graduated at Harvard in 1835, and was admitted to the bar. He was a judge of the Court of Common Pleas from 1849 to 1855, and of the State Supreme Court from 1859 to 1869. In 1869-70 he was Attorney-General of the United States. He was a member of the Joint High Commission that framed the Treaty of Washington in 1871, and was a Republican member of Congress in 1873-75.

HOAR, George Frisbie (1826-1904). An American legislator, born at Concord, Mass. He graduated at Harvard in 1846, studied law in the Dane Law School, Harvard, and then opened an office in Worcester. He was an ardent member of the Free Soil Party, and later of the Republican Party, almost from the time of its organization; and in 1852 he was elected one of its representatives in the Massachusetts Legislature. Though his ambition at this time was for a legal rather than a political career, he was induced to accept other nominations, which resulted in his serving in both branches of the State Legislature and in the United States House of Representatives, of which he was a member from 1869 until 1877, when he was chosen Senator by his State. During his last year in the House he was a member of the Electoral Commission (q.v.), chosen in 1877, which decided that Hayes had been elected President over Tilden. He presided over the Republican National Convention of 1880, which nominated Garfield and thus ended the bitter contest between Grant and Blaine. He was always a consistent opponent of 'imperialism' from the days when he aided Sumner in his opposition to the annexation of Santo Domingo; and, though he supported President McKinley for reëlection, he strongly opposed his policy in the Philippines, which he considered subversive of

American ideals. During his service in the House Mr. Hoar was one of the managers of the Belknap impeachment trial, and after his election to the Senate he was chairman of the committees on the judiciary and on privileges and elections, and a member of the committees on engineering bills, civil service and retrenchment, library claims, Nicaragua claims, and rules, as well as chairman of the select committees on woman suffrage, and relations with Canada. Among the non-political offices to which he was appointed are: Regent of the Smithsonian Institution (1880), president of the American Antiquarian Society, president of the American Historical Association, president of the Board of Trustees of Clark University (1900), and trustee of the Peabody Fund.

HOAR, Samuel (1778-1856). An American lawyer and legislator. He was born at Lincoln, Mass.; graduated at Harvard in 1802; was admitted to the bar in 1805, and soon became a prominent lawyer. He was a State Senator in 1825 and again in 1833, and was a Whig member of Congress from 1835 to 1837. In 1844 he was sent by the Massachusetts Legislature to South Carolina to dispute before the courts the constitutionality of certain laws of that State authorizing the imprisonment of free negroes coming into it. He was, however, not allowed to plead, but was forcibly expelled from Charleston by the public authorities, the South Carolina Legislature by special act authorizing the expulsion.

HOARE, Sir Richard Colt (1758-1838). An English antiquary, born at Stourhead, in Wiltshire. At twenty-five he married Lord Lyttelton's eldest daughter, and, after her death, two years later, traveled extensively over Europe. He wrote descriptions of his travels in Ireland and in Italy; a translation of Giraldus Cambrensis (1808); and, most important among his works, a *History of Ancient Wiltshire* (1821), succeeded by an incomplete *History of Modern Wiltshire*, dealing with the southern section only (1822 and 1843).

HOAR FROST. See Frost.

HOARHOUND. See Horehound.

HOARSENESS. See Throat, Affections of.

HO'BART. The capital of Tasmania, situated on the Derwent, near its entrance into Storm Bay, on the south coast of the island (Map: Tasmania, D3). Besides the Government official buildings, Hobart has a college, a technical school, two cathedrals, hospitals, a free library, museum, and art gallery. Its naturally excellent harbor and quay with three patent slips accommodate ships of the largest size. It has considerable manufactures, a large export and import trade, railway communication with Launceston, and steamship communication with Sydney, Melbourne, New Zealand, and London. It is the seat of a United States consul and the see of Anglican and Catholic bishops. With Mount Wellington as a picturesque background, regularly laid out and well-lighted streets, a good spring-water supply, street railroads, fine parks and drives, Hobart is a favorite summer resort for Australians. The mean temperature for the year is 52.3°, being 42.1° in winter, and 63.1° in summer. Population, 1891, 30,608; 1901, 31,317. It was founded in 1804.

HOBART, Garret Augustus (1844-99). An American lawyer and politician, Vice-President of the United States. He was born at Long Branch, N. J.; graduated at Rutgers College in 1863; was admitted to the bar six years later, and practiced his profession with success at Paterson, N. J., where he made his home until death. He was city counsel there in 1871; was a member of the State Assembly from 1873 to 1878, and of the State Senate from 1879 to 1885, presiding over both of those bodies. He was five times successively delegate-at-large from New Jersey to the Republican National Convention; was nominated at Saint Louis in 1896 for Vice-President on the ticket with William McKinley, and was elected to that office. To a greater extent, perhaps, than any of his predecessors in the Vice-Presidency, he made that office one of real influence and power. He was the intimate friend and counselor of President McKinley, and exercised a strong influence on the conduct of public affairs. He was interested in many banking and other business corporations, and accumulated a large fortune. He died before the expiration of his term of office, on November 21, 1899.

HOBART, John Henry (1775-1830). A Protestant Episcopal bishop of New York. He was born in Philadelphia, Pa., and was the descendant in the fifth generation of a Puritan family of New England, originally established by Joshua Hobart at Hingham, Mass. He was left fatherless in his first year and was carefully trained by his mother. He graduated at Princeton in 1793, and was tutor from 1795 to 1798, when he took orders in the Episcopal ministry. His first charges were in Philadelphia, New Brunswick, N. J., and Hempstead, L. I. In 1800 he was appointed curate of Trinity Church, New York; in 1801 was ordained priest, and after showing marked ability in parish work, in various official capacities, and as the author of several ecclesiastical manuals, was elected Assistant Bishop of New York in 1811, and assistant rector of Trinity Parish in the following year. In 1816 he became rector of Trinity and Bishop of the diocese. In 1821 he was appointed professor of pastoral theology and oratory in the New York General Theological Seminary of the Protestant Episcopal Church, of which institution he was one of the founders. Ill health caused a suspension of his labors, and he spent the years 1824-25 in Europe, studying social, moral, and religious conditions. His return in 1826 was marked by renewed literary and pastoral activity, and on his annual visitation he traveled 3000 miles, heedless of the scanty transportation facilities, in his anxious watchfulness over the growing institutions of his ever-increasing diocese. The labors of his visitations, however, at length proved too much for his declining health, and a sudden failure of his powers was followed by his death at Auburn, N. Y., September 12, 1830. His writings, which went through many editions, include: *Companion for the Altar* (1804); *Festivals and Fasts* (1804); *Clergyman's Companion* (1805); *Controversial Essays* (1806); *Apology for Apostolic Order* (1807); *The Christian's Manual* (1814); *The State of the Departed* (1814); and *A Comparison of the United States With England* (1826). He also edited D'Oyley and Mant's "Family Bible" (2 vols., 1818-20). Consult: Berrian, "Memoir," attached to the *Posthumous Works of Bishop Hobart* (New York, 1833); McVickar, *The Early Professional and Closing Years of Bishop Hobart* (New York, 1836).

HOBART, JOHN HENRY (1817-89). An American Episcopal clergyman and author, the youngest son of John Henry Hobart (q.v.). He was born in New York City, graduated at Columbia College, and was ordained in 1841. After having a charge at Baltimore, he was assistant in Trinity Church, in New York City, for fifteen years, and afterwards became rector of Trinity Church, Fishkill, N. Y. He published: *Instruction and Encouragement for Lent* (1859); *Mediævalism* (1877); and *Church Reform in Mexico* (1877).

HOBART COLLEGE. A college, situated at Geneva, N. Y., under Episcopal auspices. It was projected in 1812, and named after Bishop Hobart, through whose efforts it was organized. A provisional charter was secured in 1821, and a full charter in 1825, under the title of Geneva College. In 1852 the name was changed to Hobart Free College, and in 1860 to Hobart College. The college offers academic courses leading to the degrees of Bachelor of Arts, of Philosophy, and of Letters. It had, in 1902, 19 instructors, 100 students, a library of about 40,000 volumes, property valued at $676,895, including grounds and buildings worth $167,480, and an annual income of $31,670.

HOBART PASHA, pä'shä' (AUGUSTUS CHARLES HOBART-HAMPDEN) (1822-86). An English admiral in the Turkish service. He entered the British Navy in 1835; distinguished himself in the Crimean War, and when he retired in 1863 was captain. During the American Civil War he was a blockade-runner, and had many narrow escapes. In 1867 Hobart entered the Turkish service as naval adviser to the Sultan. His first service was in suppressing the Cretan rebellion, for which he was promoted an admiral with the title of pasha. He reorganized the Turkish fleet, which he commanded on the Black Sea against Russia, in the War of 1877-78, and in 1881 was appointed marshal of the Empire. Although his name was twice struck from the British navy list for operating against powers friendly to Great Britain, in disregard of the Foreign Enlistment Act, he was finally restored in 1885 with the rank of vice-admiral. His book, *Sketches of My Life* (1887), published posthumously, is a mixture of fact and fiction.

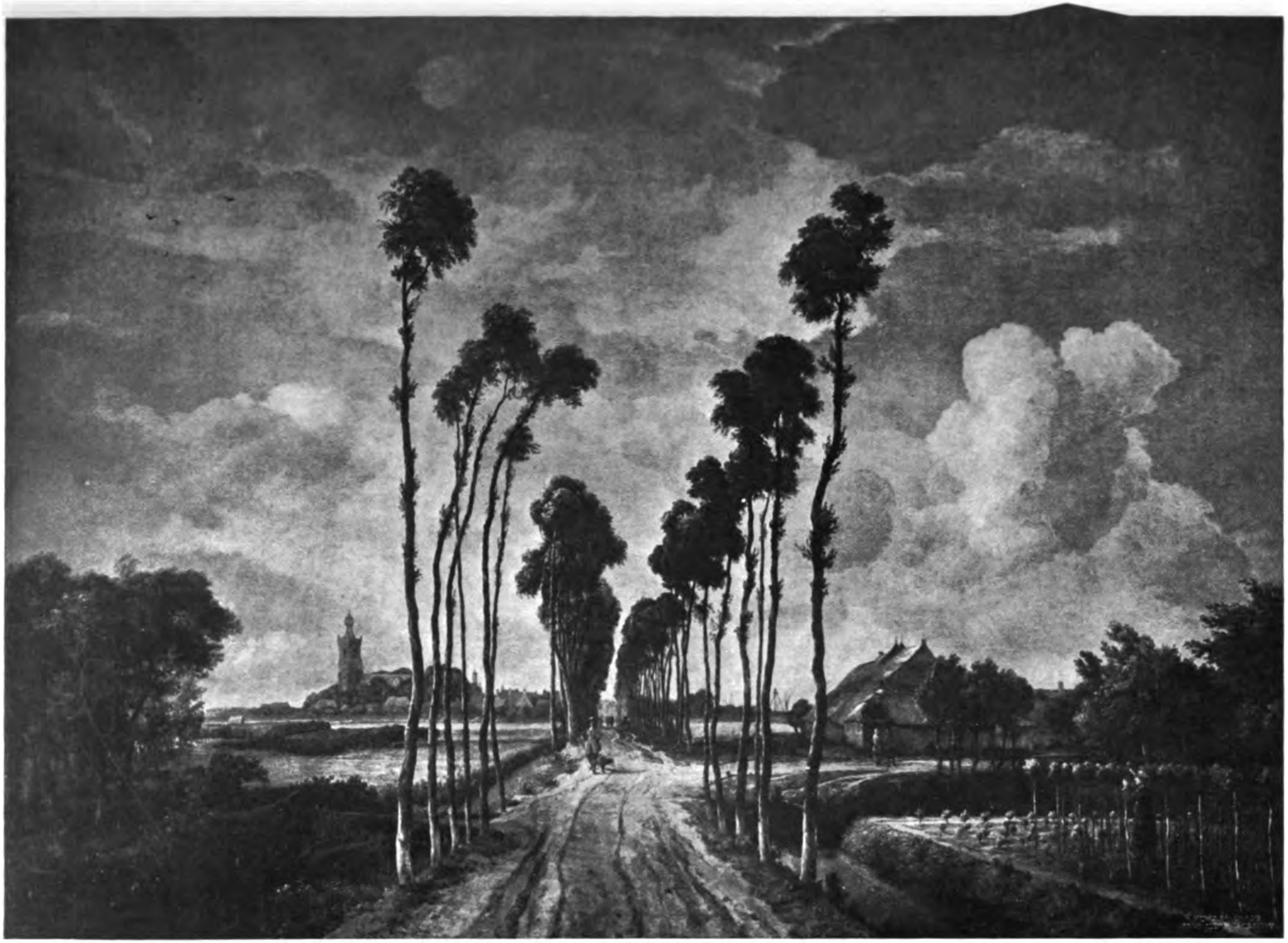
HOBBEMA, hŏb'bȧ-mä, MEINDERT (1638-1709). A Dutch landscape painter. His birthplace is unknown, although seven towns, Amsterdam among them, claim the honor. The date of birth, 1638, is verified by the statement in the record of his marriage at Amsterdam, October 2, 1668, that he was thirty years old at that time. Hobbema passed most of his life at Amsterdam, where he seems to have been a pupil of Ruysdael (q.v.). As such well-known contemporaries as Berchen, Vandevelde, and Lingelbach are said to have painted the figures in his landscapes, it seems likely that he was appreciated by the artists of his day. The general public, however, ignored his work, and he died at Amsterdam in poverty, December 14, 1709.

Hobbema and Ruysdael are the greatest landscape painters of the Dutch school; their art marks its consummation. Ruysdael is usually considered the greater of the two because his subjects are grander; he painted rocky gorges, torrents rushing through ravines, stormy autumn scenes, while Hobbema preferred the gentler aspects of nature, such as quiet woodland scenes, pools of water with subtle sunlight effects, romantic water-mills and streams. In subtlety of technique he was the equal, probably the superior, of Ruysdael. His pictures are rich in warm and golden tones, and his color has a transparent quality, with brilliant effects reflected in sky and water. His technique is bold in touch, but careful in finish of details. No one has better portrayed the magical effects of sunlight. He is more absolutely true to nature than Ruysdael; his trees are more individual, with greater variety of foliage and color. It was not until the eighteenth century that his merit was appreciated. The English were the first to acknowledge it, and therefore far the greater number of his best works are now in the private collections of England. Hobbema also exercised great influence upon the English landscape painters of the latter eighteenth century, especially upon Old Crome. At present his works are much sought after, and their high value has caused forgeries of signatures and dates upon his paintings. It is therefore impossible to date them with accuracy.

Of all public collections the National Gallery is richest in works of Hobbema, possessing five of his landscapes. The best known of these is the "Avenue Near Middelharnis, Holland," one of the towns claiming to be his birthplace. The effect of its aërial perspective is very remarkable, as is also the glowing light from the sky. Another fine picture in the National Gallery is the "Ruins of Breberode Castle," faithfully rendered, just as it now stands on the road to Haarlem. The Glasgow Gallery is rich in his pictures, and Amsterdam has several, including the famous "Water-Mill." There are also good examples in the Louvre, and in the galleries at Brussels, Berlin, Dresden, Frankfort, and Vienna. The Metropolitan Museum, New York, possesses a "Landscape View in Holland." Consult Michel, *Hobbema et les paysagistes de son temps en Hollande* (Paris, 1890).

HOBBES, hŏbz, JOHN OLIVER (PEARL RICHARDS CRAIGIE) (1867—). An English novelist, born in Boston, Mass. Her father removed to England while she was very young, and she was educated there by private tutors and later in Paris and at University College, London. She was married in 1887 to Reginald W. Craigie, but the marriage proved an unhappy one, and she secured a divorce in 1895. Among her publications are the novels: *Some Emotions and a Moral* (1891); *The Sinner's Comedy* (1892); *A Study in Temptations* (1893); *The Gods, Some Mortals, and Lord Wickenham* (1895); *A Bundle of Life* (1894); *Robert Orange* (1900); *The Serious Wooing* (1901); and *Love and the Soul Hunters* (1902); and the plays, *Journeys End in Lovers' Meeting,* for Miss Ellen Terry (1894); *The Ambassador* (1898); and *A Repentance* (1899). Her style is cynical, brilliant, and epigrammatic, especially in dialogue.

HOBBES, THOMAS (1588-1679). An English philosopher and political theorist. He was born at Malmesbury, on April 5, 1588, the son of a



HOBBEMA
"THE AVENUE OF MIDDLEHARNIS," FROM THE PAINTING IN THE NATIONAL GALLERY, LONDON

clergyman. At the age of fifteen he went to Oxford and studied the usual course of Aristotelian logic and physics. At the age of twenty, having taken his degree and quitted Oxford, he was recommended to Lord Cavendish, afterwards Earl of Devonshire, as tutor to his eldest son. Thus began an intimate connection with that great family which lasted through his long life.

In 1610 he went abroad with his pupil, and made the tour of France and Italy. After his return he still continued to live with the Earl of Devonshire's family, and his residence in London afforded him opportunities of becoming acquainted with Bacon, Ben Jonson, and the other distinguished men of the time. Meantime he was occupied with classical, political, and philosophical studies, and prepared for publication his first work, a translation of Thucydides, which came out in 1628. His interest in Thucydides was largely political. For many years he still derived his income from tutorial work, but gave his leisure to study. The political disturbances of the time made him desirous of political stability and order, which he believed could be obtained only by unquestioning recognition of the absolute power of the sovereign. This power, according to Hobbes, is neither original nor divine, but was delegated by the subjects in a compact which created the State and gave rise to all moral and political obligation. Primitive man did not live in any social or political organization. Every one was at first bent on securing his own selfish ends, but came to see that the warfare which inevitably resulted from the clash of unregulated interests was suicidal. A contract was made whereby this war of each against all—*bellum omnium contra omnes*—was brought to a close, a civil government established, and loyalty pledged to the sovereign power thus constituted. Whatever laws this power lays down are the measure of right and wrong. These views were published in various works: *De Cive* (1642); *Humane Nature* (1650); *De Corpore Politico* (1650); *Leviathan, or the Matter, Form, and Power of a Commonwealth* (1651).

After the meeting of the Long Parliament in 1640 Hobbes had returned to Paris, from his dread of the civil troubles. In 1647 he was appointed mathematical tutor to the Prince of Wales, afterwards Charles II.; but the character of his writings, especially after the publication of the *Leviathan*, so offended the Royalist clergy, in common with all other sects, that Charles was induced to part with him, and he took alarm for his personal safety and abruptly fled in 1651 to Paris; but after a short stay there, knowing that he had caused much irritation in France by his bitter attacks on the Papacy, he returned to England, where he was allowed to live quietly. Very different was his position after the Restoration; for although Charles granted him a pension of £100 a year, the dislike to his views was so general that they were condemned by the House of Commons in 1666, and he was in danger of still severer measures. His connection with the Earl of Devonshire, with whom he lived in the latter part of his life, was no doubt a powerful protection to him. His old age was fruitful in additions to his writings, and was marked by some sharp controversies. His last works were a translation of Homer and a history of the civil wars. He died on December 4, 1679.

All his Latin works were collected and published by himself (Amsterdam, 1668), and by Molesworth (5 vols., London, 1839-45). His English works were edited by Molesworth (11 volumes, including index, London, 1839-45). F. Tönnies edited and published *Behemoth, or the Long Parliament* (London, 1889).

In philosophy and psychology Hobbes was a sensationalist, and, at least at times, a materialist. All change for him is motion, hence sensuous perception is motion, and pleasure is also motion. Just why motion should appear in the form of consciousness is an inexplicable mystery. Sense-impressions, in their combinations and transformations, give rise to memory and thought. This takes place according to definite laws. The order of succession of memory-idea is that of the original sense-impressions, while the impressions originally in combination tend to reappear in the same combination; this fact he called the law of contiguity. Indeed, Hobbes is commonly regarded as the 'father of associational psychology.' Hobbes's ethics was hedonistic. It is man's desire for pleasure that made him in the first instance establish civil authority, but it is the supremacy of that authority which makes it binding now. Consult: Tönnies, "Anmerkungen über die Philosophie des Hobbes," four articles in *Vierteljahrsschrift für wissenschaftliche Philosophie* (Leipzig, 1879-81); Robertson, *Hobbes* (Edinburgh, 1886); Wille, *Der Phänomenalismus des Thomas Hobbes* (Kiel, 1888); Lewis, *Ueber den Individualismus bei Hobbes* (Halle, 1892); Sneath, *The Ethics of Hobbes* (Boston, 1898); Stephen, *Hobbes* (London, 1903); Graham, *English Political Philosophy from Hobbes to Maine* (New York, 1900).

HOBBY (OF. *hobe*, from *hober*, to move, from ODutch *hobben*, to toss, *hoppen*, to hop, AS. *hoppian*, Ger. *hopfen*, to hop). A small European falcon (*Falco subbuteo*), formerly trained in falconry to fly at pigeons and partridges. The nearest North American species is the pigeon-hawk.

HOB'HOUSE, JOHN CAM. See BROUGHTON, Baron.

HOB'KIRK'S HILL, BATTLE OF. A battle fought at Hobkirk's Hill, about two miles north of Camden, S. C., on April 25, 1781, during the American Revolution, between an American force of about 1400, under General Greene, and an English and Tory force of about 950, under Lord Rawdon. The latter, leaving his strong position at Camden, attacked the Americans with great gallantry, and after some stubborn fighting gradually forced them from the field, Greene's plan of battle being deranged by the unexpected retreat of a brigade upon which he had placed implicit reliance. The victory gave no strategic advantage to Rawdon, who on May 10th evacuated Camden and retreated toward Charleston. The loss of the Americans in killed, wounded, and missing was 271; that of the English and Tories, 258. This engagement is also known as the second battle of Camden. Consult: Carrington, *Battles of the American Revolution* (New York, 1877), and Dawson, *Battles of the United States* (New York, 1858).

HO'BOKEN. A city in Hudson County, N. J., on the Hudson River, opposite New York, of which it is a suburb, and adjoining Jersey City. It is the terminus of the Hamburg-American, North German Lloyd, Netherlands-American, and

Thingvalla steamship lines, and of the Delaware, Lackawanna and Western Railroad (Map: New Jersey, D 2.) The city lies at the base of the Palisades, the principal streets running north and south, parallel to the river. In the eastern section rises a hill. The site of Stevens Institute of Technology (q.v.) is fronted by Hudson Park. In the latter is a soldiers' monument; and in Church Square Park are situated the public library and a firemen's monument. Saint Mary's Hospital is a noteworthy structure. Hoboken is a great shipping place for coal. The most important manufactures comprise foundry and machine-shop products, lead pencils, leather goods, silk, wall-paper, and caskets. The government is administered by a mayor, elected every two years, who appoints assessors, and school, health, fire, and library commissioners, and, with the consent of the council, police commissioners, of which board he is the president. The council is unicameral and elects the city clerk and assistants, and inspectors. All other administrative officials are chosen by popular vote. The municipal income and expenditures annually amount to about $1,910,000 and $1,810,000, respectively, the main items of expense being $75,000 for the fire department, $115,000 for the police department, $150,000 for operation of the water-works, and $175,000 for schools. Population, in 1870, 20,297; in 1890, 43,648; in 1900, 59,364, including 21,400 persons of foreign birth and 100 of negro descent.

The land on which Hoboken stands was part of the patroonship granted to Michael Pauw in 1630, and was then called Hobocan Hacking, 'the land of the tobacco-pipe,' in allusion to the fact that Indians carved pipes from a kind of stone found here. A house was built about 1640 by Arendt Teunisson Van Putten, and a straggling settlement grew up; but the present city really dates from 1804, when John Stevens, 'the founder of Hoboken,' bought the land and laid out a town. During the first quarter of the nineteenth century the Elysian Fields in Hoboken were the favorite pleasure resort for New Yorkers, and became noted as the meeting-place of Federalist politicians. Hoboken was incorporated as a town in 1849, its population then being about 2000, and in 1855, with a population of about 6700, it was chartered as a city. In 1900 a fire at the wharves of the North German Lloyd Steamship Company caused the loss of about 200 lives, and destroyed property, including three steamers, valued at $5,000,000. Consult Winfield, *History of the County of Hudson* (New York, 1874).

HOB'SON, John Atkinson (1858—). An English educator and author, born at Derby. He was educated at Lincoln College, Oxford; from 1880 to 1887 was classical master in schools at Faversham (Kent) and Exeter, and from 1887 to 1897 was lecturer in English literature and economics for the University Extension Delegacy and the London Society for the Extension of University Teaching. From the time of the appearance of his *Problems of Poverty* (1891, No. 2 in the "Social Questions of To-day" series) he became known as one of the more prominent British economists of the recent school, and a very effective writer. His other publications include: *The Physiology of Industry: Being an Exposure of Certain Fallacies in Existing Theories of Economics* (1889; with A. F. Mummery); *The Evolution of Modern Capitalism* (1894); *Coöperative Labour upon the Land, and Other Papers* (1895); *The Problem of the Unemployed: an Enquiry and an Economic Policy* (1896); *John Ruskin, Social Reformer* (1898), a very careful and interesting analytical treatise in vindication of Ruskin's humanization of political economy, and containing also valuable accounts of the industrial experiments furthered and directed by Ruskin; *The War in South Africa: Its Causes and Effects* (1900); *The Economics of Distribution* (1900), an important attempt to reconcile and systematize the various theories of price and value; *Capitalism and Imperialism in South Africa* (1900; a monograph reprinted from the *Contemporary Review*); *The Psychology of Jingoism* (1901); and *The Social Problem; Life and Work* (1901), in which he develops socialistic theories to the extent of maintaining the necessity of the acquisition of monopolies by municipalities, commonwealths, or nations. He also contributed extensively to technical and popular reviews.

HOBSON, Richmond Pearson (1870—). An American naval constructor, born in Greensboro, Ala. He entered the Southern University in 1882, but three years afterwards accepted an appointment to the United States Naval Academy, where he graduated in 1889, and then took a post-graduate course at the Ecole Nationale Supérieure des Mines and the Ecole d'Application du Génie Maritime, in Paris. He served on various naval stations and at the New York and the Newport News navy-yards, and in 1897 he was ordered to Annapolis to organize a post-graduate course for those officers who intended to enter the construction corps. During the war with Spain he was present at the bombardment of Matanzas, and took part in the expedition against San Juan de Puerto Rico; but his great achievement was the sinking of the collier *Merrimac* across the entrance to Santiago Harbor before daylight, on June 3, 1898, in order to 'bottle up' Cervera's fleet. He did not succeed in accomplishing the desired result, but the daring of the exploit made popular heroes of all concerned in it. After the war he raised and refitted several of the Spanish war-ships which had been sunk in Cuban and Philippine waters. He resigned from the Navy in 1903. Among his publications are *The Disappearing Gun Afloat*, and *The Sinking of the Merrimac*.

HOBSON'S CHOICE. A term used to signify that a person must take what is offered or go without, i.e. 'This or none.' The phrase arose at Cambridge, in Milton's time, where one Tobias Hobson kept stables and used to let out horses to the students. Every customer was courteously given his choice of horses, but he invariably found that he was obliged to take the horse which happened to be nearest the door or go without.

HOC'CLEVE, or **OCCLEVE,** Thomas (1370?-1450?). An English poet. Concerning his life very little is known. For twenty-four years he was clerk in the Privy Seal Office, London. His principal work, *De Regimine Principum* (Concerning the Duties of Kings), mainly a digest of a Latin treatise under the same title by Ægidius Colonna, consists of 5488 lines in Chaucer's seven-line stanza. In the prologue, which comprises about a third of the work, Hoccleve mentions some incidents of his life. He says he was poor and his pension not paid; and laments the death of Chaucer, who is called the "floure of eloquence." The rest of the long poem is devoted mainly to moral reflections on the manners of the time. On the margin of one of the MSS. Hoccleve drew in colors the well-known portrait of Chaucer, his 'maister dere.' Hoccleve also wrote several other poems, among which is the beautiful orison to the Virgin, beginning "Mother of God and Virgin undefouled." This last poem may be only a copy from Chaucer. Consult *Works*, ed. F. J. Furnivall for the Early English Text Society (London, 1892-97).

HOC'CO (native name in Guiana). A native name applied by Buffon to curassows in general, but apparently applicable and now restricted especially to the Mexican species (*Crax alector*), also called 'royal pheasant' by the Mexicans. Consult Sumichrast, "Native Birds . . . of Vera Cruz," in *Memoirs of the Boston Society of Natural History*, vol. i., pt. iv. (Boston, 1869). See Curassow.

HOCHBERG, hôɢ'bĕrᴋ, Bolko, Count von (1843—). A German patron of music and dramatic composer, whose earlier music appeared under the pseudonym 'J. H. Franz.' He was born at Castle Fürstenstein, in Silesia; studied law at Bonn and Berlin, and soon gave up the diplomatic service to devote himself to music. Hochberg founded in 1870 the Silesian musical festivals, to the success of which he greatly contributed. In 1886 he was appointed general superintendent of the Court theatre of Berlin, and in 1897 he was made an hereditary member of the Prussian House of Lords. Besides symphonies, songs, and string quartets, he composed *Claudine von Villabella* (1864) and *Der Wärwolf* (1876).

HOCHE, ôsh, Lazare (1768-97). A general of the French Revolution. He was born June 25, 1768, at Montreuil, near Versailles. In 1784 he entered the Army, but joined the National Guard at Paris in 1792 as a sergeant of grenadiers. Owing to his military experience and soldierly qualities, he rapidly obtained promotion. In 1793, after distinguishing himself under Leveneur, he was made Adjutant-General of the Army of the North. Some hasty words, caused by the arrest of his chief, Leveneur, brought about Hoche's arrest, but he was acquitted by the revolutionary tribunal at Douai and restored to his command, and aided Souham in the defense of Dunkirk. Having succeeded in repulsing the Duke of York, Hoche was made a general of division and given the command of the French forces on the Moselle, and in spite of the numerical superiority of the enemy succeeded in driving the Austrians out of Alsace, after defeating them at Weissenburg (December 26, 1793). His important services were requited, however, by suspicion and arrest, and had it not been for the downfall of Robespierre Hoche would probably have perished on the guillotine. On being set at liberty he received the command of the army operating in the west, and completely defeated the émigré army of invasion near Quiberon Bay in July, 1795. He was next intrusted with the task of suppressing the royalist revolt in La Vendée, and at the head of an army of 100,000 men succeeded in pacifying the country in less than a year. In December. 1796, he commanded the army destined for the invasion of Ireland, but adverse conditions of wind and weather scattered his ships and made the expedition a failure, though a part of the fleet succeeded in reaching the Irish coast. Hoche was then made commander of the Army of the Sambre and Meuse, and in the spring of 1797 won several victories over the Austrians. The preliminaries of Leoben put an end to his activity, and on September 19, 1797, he died very suddenly at his camp at Wetzlar, though not by poison, as some have supposed. There are numerous biographies of Hoche, the best being: Desprez, *Lazare Hoche, d'après sa correspondance* (Paris, 1858); Dutemple, *Vie politique et militaire du général Hoche* (Paris, 1879); Font-Réaulx, *Le général Hoche* (Paris, 1890); Griffiths, *French Revolutionary Generals* (London, 1891).

HOCHKIRCH, hōɢ'kêrᴋ, or **HOCHKIRCHEN.** A village in the District of Bautzen, in Saxony. It was the scene of a battle between the Austrians and Prussians (October 14, 1758) during the Seven Years' War. Frederick the Great of Prussia, with an army 30,000 to 40,000 strong, having taken up an almost untenable position at Hochkirch, was surprised in the night-time, under cover of a thick fog, by Marshal Daun, with 65,000 Austrians, and compelled to retire to the heights of Drehsa. Here he was again attacked by the Duke of Aremberg, and after a conflict of five hours' duration, again retired. He lost 9000 men killed and wounded, and 100 guns. He himself and almost all his generals were wounded. The Austrians lost 6000 men. On May 21, 1813, a battle took place here between the French and the Allies. See Bautzen.

HÖCHST, hĕɢst. A town in the Prussian Province of Hesse-Nassau, at the confluence of the Nidda and the Main, 7½ miles northwest of Frankfort (Map: Germany, C 3). Höchst has one of the largest paint-factories in Germany, employing about 2500 men. There are also large porcelain-works, established in 1740, and manufactures of tobacco, gas, and water-mains, machinery, oilcloth, gelatin, and furniture. Höchst was made a city in 1400. Population, in 1890, 8455; in 1900, 14,121.

HÖCHSTÄDT, hĕɢ'stĕt. See Blenheim.

HOCHSTETTER, hôɢ'stĕt-tĕr, Ferdinand von (1829-84). An Austrian geologist, born at Esslingen, Württemberg. He was a member of the *Novara* expedition in 1857, and made a special study of the geology of New Zealand and the gold-fields of Australia, the results of which were published in the account of the expedition and in a small work on New Zealand. After his return to Europe he was appointed a professor at the Vienna Imperial Polytechnic Institute, and afterwards director of the Imperial Museum of Natural History. He wrote an authoritative work on the geology of Turkey and the Ural region, and published, together with Hann and Pokorny, the *Allgemeine Erdkunde*.

HOCK, HOUGH (AS. *hōh*, OHG. *hahsa*, Ger. *Hechse*, hock; ultimately connected with Lat. *coxa*, thigh, Skt. *kakṣa*, armpit). The joint between the knee and the fetlock in a horse's hind leg. *Hock-joint*, the hinge formed by tibia and astragalus.

HOCK'DAY (from AS. *hēah*, high + *dæg*, day). The second Tuesday after Easter; formerly a popular festival in England observed as late as the sixteenth century. Hockday and Michaelmas (q.v.) were the rent-days in rural England. Hocktide or Hockdays included Hock-Tuesday and the day before. The origin of the festival is uncertain.

HÖCKERT, hĕk'ĕrt, Johann Fredrik (1826-66). A Swedish genre and historical painter, born at Jönköping. He studied art at Stockholm, went with Boklund to Munich (1846-49), from 1851 to 1857 studied in Paris, and traveled extensively in the Netherlands, Spain, Italy, and Northern Africa. His importance in Swedish art lies especially in his coloring. He was styled the 'Swedish Delacroix,' and in this point must be held one of the greatest artists of his country during the century. Höckert's best pictures are scenes of life in Lapland, where he had traveled in 1849 with the botanist Andersson. Besides, he painted a few portraits and many historical pictures such as "Christina Ordering the Execution of Monaldeschi" (1853); "The Rescue of Gustavus Vasa" (1858); and the uncompleted canvas "Burning of a Palace in Stockholm, 1697." Better known are: "Service in a Lapland Chapel," which received a gold medal at the Exposition of 1855, and is now at Lille; "Interior of a Hut in Lapland" (1858), at the Stockholm Museum; and the "Rättoiks Maiden," a Swedish genre canvas, now at Göteborg.

HOCK'ET (OF. *hoquet, hocquet, houquet,* hiccough; so called from the broken effect). One of the very oldest forms of composition, much in vogue during the twelfth and thirteenth centuries. After the fourteenth century the hocket seems to have disappeared entirely. It was a composition for two or three voices where one voice suddenly, and at irregular intervals, interrupted the other voices. It really was more contrapuntal trickery than a serious art-form. The English *catch* (q.v.) is very much like the hocket.

HOCKEY (also *hawkey, hookey,* apparently from *hook,* in allusion to the hooked club with which the game is played). A game played by opposing teams of eleven each, now divided into five forwards, three half-backs, two backs, and a goal-keeper, on a ground one hundred yards long by fifty or sixty wide. The playing space is indicated by white side lines and end or goal lines. The goals, one at each end, consist of two upright posts twelve feet apart and a horizontal bar seven feet from the ground. In front of each goal is a semicircular white line fifteen yards from it, curving back to a point twelve feet from each goal-post. No goal counts unless the ball was last hit, by one of the attacking side, inside this semicircle. The shape of the hockey-stick is not regulated, except that it must have no sharp edges or metal on it, and it must be able to be passed through a ring two inches in diameter. It is usually curved at the bottom end, and weighs in the neighborhood of 25 ounces. The ball is an ordinary cricket-ball painted white. The play is started from the centre of the ground by a bully, i.e. one player of each side takes position on opposite sides of the ball. Each strikes the ground on his side of the ball, and then each strikes his opponent's stick three times, alternately, over the ball. Either of the two can then strike the ball. When it is driven over the end lines by the attacking party, it is brought back to within 25 yards of the goal-line and started by another bully. When a defending party hits it over the goal-lines the penalty is a free hit by the attacking party from the corner flag. There are various penalty bullies. A goal is scored when the ball has been driven in a lawful manner, i.e. by a stroke in which the stick does not rise above the shoulder, and from within the prescribed 'striking circle' between the goal-posts and under the cross-bar. The ball may be caught and immediately dropped, or stopped with any part of the body; but must not be carried, or kicked, or knocked, except with the stick. When a ball passes the side lines it is rolled along the ground from the spot where it crossed by one of the opposite side to that of the player who last touched it. The game is usually played for seventy minutes in two halves, the players changing ends at the interval.

The game remained in an unorganized condition in England, its original home, until 1883, when the first modern rules were reduced to definite shape by the Wimbledon Club. In 1886 the Hockey Association was organized, followed in rapid succession by many county associations. Ireland and Wales also have national associations, and since 1894 international matches have been played yearly. In the United States, except as played on the ice, the game still remains imperfectly organized.

Ice Hockey. The old winter game of hockey, or shinney, is the basis of the modern game of ice hockey, but the modern game is more scientific than its English and Scotch predecessors. The old game was played on more or less frozen ground, and the players cared more about action than rules, and, in the beginning, no restrictions existed as to the number on each side, the shape or proportion of the sticks, the size or material of the ball, the size of the playing space, or even the manner of making a goal. Order was brought out of chaos by the McGill University team and the Victorias of Montreal, and by other clubs cooperating with them, between 1881 and 1884. In 1887 the Hockey Association of Canada was formed, and the game fairly entered on a new career. Since then various local associations have been formed, among which the most prominent are the Manitoba and Northwest Amateur Hockey Association and the Ontario Hockey Association. The emblem of supremacy among the various leagues is 'the Stanley Cup,' presented by Lord Stanley, a former Governor-General of Canada. The game was introduced in the United States by a Canadian studying in Baltimore: thence it spread to Yale, Cornell, and other colleges, in a zone limited by natural conditions or by the presence of rinks of artificial ice. Around New York the important teams have combined to form 'the Amateur Hockey League,' whose series of matches may be considered the special feature of the season's play. The Western Pennsylvania League centres around Pittsburg; and the game flourishes also in Chicago, Baltimore, Philadelphia, Washington, and other large cities.

Though among the first to play the game, the colleges have not until recently taken up the sport as an intercollegiate one. Now, however, it occupies an important position in the winter games of the larger Eastern colleges. Wherever there is a possibility of sufficient practice, college teams rival in excellence the best of the clubs. In England and Scotland ice hockey found a ready field, but it is sadly limited there by the absence of adequate rinks. The rules of the game vary slightly with the various local associations, and the rules of each must be consulted in actual play. Consult Heathcote and Trebutt, *Skating, Curling, and Ice Sports* (London, 1892).

HOCK'ING. A river in Ohio, rising near Lancaster, Fairfield County (Map: Ohio, F 7). It flows southeast through a picturesque region, and empties into the Ohio River below Parkersburg, West Virginia, after a course of 80 miles. Boat navigation is possible for about 70 miles, and can be continued through the Hocking Canal, which passes along its shore.

HOCKING, Silas Kitto (1850—). An English novelist, born at Saint Stephen's, Cornwall. He entered the Wesleyan ministry and held several pastorates, but resigned in 1896. His novels, beginning with *Alec Green* (1878), which have a strong flavor of Methodism, have been very popular. The hero of *God's Outcast* (1898) is a Methodist minister who married the wrong woman. *Israel Pendray* (1899) is an account of Wesley's preaching in Cornwall. *Mistress Nancy Molesworth* (1899) is a story of adventure in Cornwall in 1745. Among his other novels are *The Awakening of Anthony Weir* (1901) and *Gripped* (1902).

HODEIDA, hô-dĕ'ī-dȧ. An important seaport of Yemen, Arabia, situated on the coast of the Red Sea, about 100 miles north of Mocha (Map: Turkey in Asia, Q 13). Its roadstead is somewhat obstructed by coral reefs, but its commerce is nevertheless very important, it being the chief centre of the Arabian coffee trade. Hodeida is the chief landing-place for Mecca pilgrims from Africa. Population, estimated at 25,000.

HODELL, hō'dĕl, Frans Oscar Leonard (1840-90). A Swedish dramatist and poet, born at Stockholm. He was in early life an actor, then editor (1870) and proprietor of the *Söndagsnisse*, a humorous journal. He was the author of a number of plays, such as the popular *Andersson, Petersson, och Lundström* (1866), and wrote also some verses and ballads, under the title, *Visor och kupletter* (1873).

HODGE. (1) In *Gammer Gurton's Needle*, the husband of Gammer Gurton, whose breeches she was mending when the needle was lost. (2) The conventional class name for the English farmer or countryman.

HODGE, Archibald Alexander (1823-86). An American Presbyterian theologian and author, the son of Charles Hodge (q.v.). He was born at Princeton, N. J.; graduated at Princeton in 1841, and was an assistant professor there from 1844 to 1846. In 1847 he graduated at the Princeton Theological Seminary, and for three years was missionary at Allahabad, India, under the auspices of the American Presbyterian Missionary Society. After 1851 he held pastorates in Maryland, Virginia, and Pennsylvania, and in 1864 was called to a church in Allegheny, Pa., where, until 1877, he was also professor of didactic theology in the Western Theological Seminary. In 1878 he succeeded to the chair of didactic, exegetical, and polemic theology at Princeton, made vacant by the death of his father, to whom he had been appointed assistant professor the year before. He was a trustee of Princeton College, and edited for a period the *Presbyterian Review*. His published works include: *Outlines of Theology* (1860; new ed. 1879); *The Atonement* (1868; new ed. 1886); *Life of Charles Hodge, Professor in the Theological Seminary, Princeton* (1880); *Manual of Forms, Conformed to the Doctrine and Discipline of the Presbyterian Church* (1883); and *Popular Lectures on Theological Themes* (1887).

HODGE, Charles (1797-1878). An American Presbyterian theologian and historian, of Scotch-Irish descent. He was born in Philadelphia; graduated at Princeton in 1815, and at the theological seminary there in 1819. became assistant professor in his alma mater the following year, and with the exception of an interval of two years (1826-27) in Europe, studying at the universities of Paris, Halle, and Berlin, was connected with its faculty until his death. From 1822 he was professor of Oriental and biblical literature, and from 1840 professor of didactic and exegetical theology, polemic theology being added in 1852. In 1872 the semi-centennial anniversary of his professional life was commemorated at Princeton by the foundation of the 'Charles Hodge professorship,' with an endowment of $50,000. He was also the recipient of a gift of $15,000. In 1846 he was moderator of the Presbyterian General Assembly, and in 1858 was one of the revisers of the *Book of Discipline*. He was editor of the *Biblical Repertory*, which he founded in 1825, expanding the title four years later to *The Biblical Repertory and Princeton Review*. It was the organ of the old school of Presbyterian theology until 1871, when the journal became the *Presbyterian Quarterly and Princeton Review* of the new Presbyterian School, and Professor Hodge retired from the editorship. His chief work, *Systematic Theology* (3 vols., 1871-72), is still considered one of the best interpretations of the Calvinistic doctrine. Other important works are: a *Constitutional History of the Presbyterian Church in the United States* (2 vols., 1840-41); *The Way of Life* (1842); and *What is Darwinism?* (1874). He also published several commentaries. Consult: *The Semi-Centennial Commemoration of the Professorship of Charles Hodge, D.D., LL.D., September 24, 1872* (Philadelphia, 1872); and Hodge, *Life of Charles Hodge, Professor in the Theological Seminary, Princeton* (New York, 1880).

HODGE, Frederick Webb (1864—). An American ethnologist, long connected with the Smithsonian Institution. He was born at Plymouth, England, but came to America in 1871, and was educated in the public schools and in Columbian University. In 1886 he was made secretary of the Hemenway Archæological Expedition, and in this position he traveled through Arizona and New Mexico until 1889, when he joined the Bureau of Ethnology of the Smithsonian Institution. His work here was the preparation of a *Cyclopedia of Indian Tribes*. In 1895, 1897, and 1899 he explored New Mexico and Arizona again, and on the second trip he scaled the Enchanted Mesa. In 1901 he became executive officer of the Smithsonian Institution. His more important works are: *List of Publications of the Bureau of Ethnology*, written while he was librarian of that department (1894); *The First Discovered City of Cibola* (1895); a pamphlet on *Coronado's Route from Culiacan to Quivira* (1899); and his contributions to the *American Anthropologist*, of which he was managing editor.

HODGE, Hugh Lenox (1796-1873). An American physician, born in Philadelphia, the brother of Charles Hodge. He graduated at Princeton in 1814, studied medicine, and began to practice in 1820. During the cholera epidemic of 1838 he successfully employed a system of treatment largely based on observations made during a two years' residence in India. In 1835 he was appointed professor in the University of Pennsylvania, and retained his connection there until 1863.

HODGES, John Sebastian Bach (1830—). An American clergyman of the Protestant Episcopal Church, born in Bristol, England (son of Dr. Edward H. Hodges, organist of Trinity Church, New York City). He came to this country in 1845, and was educated in Columbia College and at the General Theological Seminary of New York. After short periods of ministerial service in Newark, N. J., and in the West, he became rector of Saint Paul's Church, Baltimore, in 1870. His musical compositions, which include chants, anthems, and hymn tunes, are widely known. His chief work is the *Book of Common Praise* (1886), compiled as a companion to the *Book of Common Prayer.*

HODGINS, hŏj′ĭnz, John George (1821—). A Canadian educator. He was born in Dublin, but was brought to Canada as a child and was educated there. He graduated at Victoria College, Coburg, and studied law afterwards at Toronto University. In 1844 he became connected with public education, and in 1876 was made Deputy Minister for Ontario. His publications include a number of school books.

HODGKIN, hŏj′kĭn, Thomas (1831—). An English banker and historian. He was born at Tottenham, studied at the Friends' Grove House School there and at University College, London. He studied law, but poor health forbade him to practice, so he busied himself at banking and built up a large firm, Hodgkin, Barnett & Co., with offices throughout England. In 1874 he gave himself up to literary work. His more important writings are: the extremely valuable *Italy and Her Invaders* (1880-99); *Letters of Cassiodorus* (1886); *The Dynasty of Theodosius* (1889); *Life of Theodoric* (1891); *Life of George Fox* (1896); and *Life of Charles the Great* (1897).

HODGKINSON, hŏj′kĭn-son, Eaton (1789-1861). An English civil engineer, born at Anderton, Cheshire. After a rather desultory schooling in which he displayed an aptitude for mathematics, he undertook a course of scientific investigation that soon won him distinction. His first important work was on strains and the strength of materials, on which subject he read a paper before the Literary and Philosophical Society of Manchester in 1822. In 1828 and in 1830, respectively, he gave to the same society the results of his researches on the forms of the catenary in suspension bridges, and on the strength and best forms of iron beams. In 1847 he was appointed professor of the mechanical principles of engineering at University College, London. From 1847 to 1849 he was one of the royal commissioners engaged in inquiring into the application of iron in railroad structures. From 1848 to 1850 he was president of the Manchester Literary and Philosophical Society. He was a member of the Geological Society, of the Royal Irish Academy, and an honorary member of the Institute of Civil Engineers. He made investigations as to the temperature of the earth in deep mines which were of especial interest. His experiments on the strength of materials, and especially his determination of the 'neutral line' in the section of fracture, with the resultant designs for beams, mark an important step in the science of modern engineering. He published *Researches on the Strength and Other Properties of Cast Iron* (1846). Consult the "Life of Eaton Hodgkinson," in the *Memoirs of the Manchester Literary and Philosophical Society,* third series, No. ii. (Manchester, 1862).

HODG′SON, Brian Houghton (1800-94). An English Orientalist and zoölogist, born at Lower Beeches, and educated at Haileybury. He entered the English civil service at Calcutta in 1818, and remained in it until 1843, when he was removed, apparently without cause, by Lord Ellenborough. Hodgson then lived for a few months in Europe, but soon returned to India, and lived practically alone at Darjiling (1845-58), where he made important additions to the classified fauna of India. Besides his zoölogical specimens he made valuable collections of Indian manuscripts and of ethnological material. These collections he distributed generously among European museums, giving especially to the British Museum. His written studies were on the ancient texts of India, especially the literature of Buddhism, on the modern vernacular and the subject of 'national education,' on the ethnology of the hill tribes, on Hindu law and practice, especially in Nepal, and on zoölogy. Among his works, besides scores of articles in reviews and governmental bulletins, may be mentioned: *Literature and Religion of the Buddhists of the North* (1841); *Letters on National Education for the People of India* (last ed. 1847); *Aborigines of India* (1847); *Essays on the Language, Literature, and Religion of Nepal and Tibet* (1874); and *Miscellaneous Essays Relating to Indian Subjects* (1880). Consult Hunter, *Life of Brian Houghton Hodgson* (London, 1896).

HODGSON, John Evan (1831-95). An English painter. He was born in London, and educated at Rugby. He spent some years in Russia before entering the Royal Academy in 1855. His first picture, "The Notice of Ejectment," was exhibited in 1856. He first painted domestic and historical pictures, but in 1868 a visit to Northern Africa interested him in subjects of Moorish life, to which he chiefly confined himself from this time on. Among his earlier pictures are: "Arrest of a Poacher," "Canvassing for a Vote," "A Rehearsal of Music in a Farmhouse," "Return of Sir Francis Drake from Cadiz," "First Sight of the Armada," and "Queen Elizabeth at Purfleet." His later works include an "Arab Story-Teller" (1869); "A Tunisian Birdseller" (1873); "An Eastern Question," "A Shipwrecked Sailor" (1881); "Robert Burns at the Plough" (1887). In 1879 he was elected member of the Royal Academy, and in 1882 he was appointed its librarian and professor of painting. He died June 19, 1895, at Cobleskill, Buckinghamshire.

HODGSON, Shadworth Holloway (1832—). An English metaphysician, born in Boston, Lincolnshire, and educated at Rugby and Oxford. In 1880 he became president of the Aristotelian Society for the systematic study of philosophy, was frequently reëlected, and in his addresses to the society and its proceedings gave much of his best work. Besides these, various contributions to *Mind* and the miscellaneous works, *The Principles of Reform in Suffrage* (1866), and *Outcast Essays and Verse Translations* (1881), mention should be made of the preliminary studies entitled: *Time and Space* (1865); *The Theory of Practice* (1870); and *The Philosophy of Reflection* (1878); and of the summing up of his metaphysic, *The Metaphysic of Experience* (1898), the most forcible and valuable of his works, in which he claims that "metaphysic like pure mathematic is fontal and preinductive," and as a phenomenist takes a strong stand against the *Noumenon.*

HÓDMEZÖ-VÁSÁRHELY, hŏd'mĕ-zē-vä'-shär-hĕly'. A city in the County of Csongrád, Hungary, on the Hód (Moon) Lake, 16 miles northeast of Szegedin (Map: Hungary, G 3). Among its principal buildings are the town hall, hospitals, and a gymnasium. It has risen into considerable prominence as an agricultural and trading centre, the inhabitants of the city and neighborhood being actively engaged in stock-raising and the cultivation of wine and tobacco. The industrial establishments include breweries and an oil-factory. Population, in 1890, 55,475; in 1900, 60,883; mostly Magyars.

HOD'OGRAPH (from Gk. ὁδός, *hodos*, way + γράφειν, *graphein*, to write). A velocity curve, representing the acceleration of a given motion. In Fig. 1, V_1, V_2, V_3.... represent the velocities of a point P, which moves along the curve C, at the various positions P_1, P_2, P_3.... In Fig. 2, OV_1, OV_2, OV_3.... are drawn parallel and equal to V_1, V_2, V_3.... The curve H, formed by joining the points V_1, V_2, V_3, is called the hodograph of the motion of P. If V describes the curve H, while P describes the curve C, then the velocity of V at any point, laid off on the tangent of the curve H at that point, represents the acceleration of the point P both in magnitude and direction. Thus the velocity of the hodograph is the acceleration of the original motion.

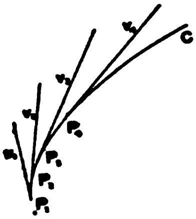


FIG. 1.

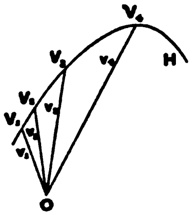


FIG. 2.

HOD'SON, WILLIAM STEPHEN RAIKES (1821-58). An English soldier, born near Gloucester. In 1845 he joined the army in India and participated in the Sikh War. Two years afterwards he had command of native troops, and distinguished himself during the mutiny as leader of the irregular cavalry called Hodson's Horse. He held a civil office in 1849-52, but was more successful as a soldier, and died the death of one at Lucknow.

HO'DY, HUMPHREY (1659-1707). A Church of England divine. He was born at Odcombe, Somersetshire, January 1, 1659; graduated B.A. at Oxford, 1679; became fellow of Wadham College there, and in 1697-98 regius professor of Greek. He died near Bath, January 20, 1707. He participated on the Government side in the controversy over the bishops and their followers who refused to accept William and Mary as their legal sovereigns—the so-called Nonjurors; and also in that about the rights and powers of Convocation, contributing the valuable *History of English Councils and Convocations and of the Clergy's Sitting in Parliament* (London, 1701). But his lasting reputation rests upon his work on the Hebrew text, the Septuagint, and Vulgate version of the Bible, *De Bibliorum Textibus* (1705). His life, written largely by himself, appears in Jebb's edition of his *De Græcis Illustribus* (London, 1742).

HOE (from OF. *houe, hoe*, from OHG. *houwa*, Ger. *Haue*, hoe, from OHG. *houwan*, Ger. *hauen*, AS. *hēawan*, Eng. *hew*). An agricultural implement used for stirring the soil, drawing up earth to plants, thinning plants in drills, clearing the ground of weeds, etc. There are two classes of hoes—*draw-hoes* and *thrust-hoes*. In the former the blade is almost at right angles to the handle; in the latter, almost in the same plane with it. The thrust-hoe, or Dutch hoe, is chiefly used for killing weeds, and for stirring ground to a very slight depth. The draw-hoe is much used in gardening, and is, in some countries, very extensively used in place of the spade in agriculture. It is always employed in the thinning (singling) of turnips. Hoes intended for tilling the ground, instead of the plow and spade, are much larger and heavier than those ordinarily used, are raised much higher, and brought down to the ground with greater force, somewhat like the pickaxe. Hoes for stirring very stiff soils are sometimes made with prongs instead of a blade.

HOE. The name of a family prominently identified with the manufacture and improvement of the printing-press in America.—ROBERT (1784-1833) was born in Leicestershire, England. He was indented to a joiner, in 1803 emigrated to the United States, worked for a time at his trade, and subsequently was an associate of his brothers-in-law, Peter and Matthew Smith, in the manufacture of a hand printing-press invented by the former. In 1823 he became sole proprietor of the business. A skillful mechanic, he constructed and introduced the original Hoe press, and was, it is thought, the earliest American machinist to utilize steam as a motive power in his plant.—RICHARD MARCH (1812-86), son of the foregoing. He began the practical study of printing-press manufacture in 1827, and in 1833 became the senior partner of the Hoe firm. He devised numerous ingenious improvements in the presses, and also produced a fine quality of steel saw. In 1841 he, in connection with his brothers, Peter Smith Hoe and Robert Hoe, took over the entire direction of the business. A rotary press, widely known as 'Hoe's lightning press,' was brought out by him in 1846, and forthwith was very extensively adopted for newspaper work. (See PRINTING.) Afterwards he invented the web perfecting press, which superseded his former invention and prints upon both sides of the sheet, and includes complicated apparatus for cutting and folding. (See PRINTING.) Constant improvements were made by him in the output of his works.—ROBERT (1839—), a son of Robert Hoe, 2d, succeeded to the headship of the firm, which retains its preëminence among printing-press makers. He was one of the organizers and first president of the Grolier Club, the well-known New York organization for the promotion of book-making as an art. He edited Maberley's *Print Collector* (1880). See Printing.

HOECKE, van den. A family of Flemish painters. Jan (1611-51), a portrait and figure painter, was a pupil of his father, Caspar, and of Rubens. After studying also in Italy and executing commissions for the Emperor of Austria, he settled, in 1647, in Antwerp, as court painter to the Archduke Leopold Wilhelm. With that prince's collection, a number of his best works came into the possession of the Vienna Gallery; others are at Antwerp. His portraits resemble Van Dyck's rather than those of Rubens. His brother Robrecht (1622-48), also a pupil of his father, was an architect of note. As controller of the fortifications of Flanders, he painted many views of camps, battles, and cities, very detailed in execution and pleasing in color. His work is also well represented in the Vienna Gallery.

HOEFER, hẽ'fẽr, Edmund (1819-82). A German novelist. He was born at Greifswald, was educated there, and in the universities of Heidelberg and Berlin. His first stories appeared in 1845, and from that time onward he wrote many novels marked by excellence of characterization, such as: *Schwanwiek* (1856); *Bewegtes Leben* (1856); *Norien. Erinnerungen einer alten Frau* (1858); *Die Honoratiorentochter* (1861); *Altermann Ryke* (1865); *Ein Findling* (1868); *Der Junker* (1878); and *In der letzten Stunde* (1881). The eighth edition of his *Wie das Volk spricht* was published in 1876.

HOEFNAGEL, hōōf'nä'gel, Jooris (1545-1618). A Dutch miniature painter, born at Antwerp. He was a pupil of Jan Bol at Mechlin, and for some time was at the Court of Bavaria. He then went to Prague, and finally to Vienna. His masterpiece is in the museum there, a Roman missal done for the Archduke Ferdinand. It is elaborately ornamented, and he worked on it for eight years (1582-90). Another fine work of Hoefnagel's is a miniature view of Seville (1573), in the Brussels Museum.—His son Jakobus (1575-?) was Court painter to the Emperor Rudolph II.

HOENSBROECH, hĕns'brĕk, Paul, Count (1852—). A German theologian, born at Castle Haag, in the Province of Gelderland. When nine years old he entered the Jesuit school in Feldkirch. Afterwards he attended the Jesuit college at Stonyhurst, in England, and then studied law and history at the universities of Bonn, Würzburg, and Göttingen. In 1876 he set out on his travels through France, Portugal, Spain, Northern Africa, and Italy, and in 1878 entered the Society of Jesus. While a member of the Society he wrote: *Der Kirchenstaat in seiner dogmatischen und historischen Bedeutung* (1889), and *Christ und Widerchrist. Ein Beitrag zur Verteidigung der Gottheit Christi und zur Charakteristik des Unglaubens in der protestantischen Theologie* (1892). In 1893 he left the Jesuit Order, and published a work entitled *Mein Austritt aus dem Jesuitenorden* (1893), which led to a bitter attack upon him by the Ultramontane press. Two years later he joined the Evangelical Church. His later writings include: *Moderner Jesuitismus* (1893); *Der konfessionelle Friede und die deutschen Jesuiten der Gegenwart* (1896); and *Das Papsttum in seiner socialkulturellen Wirksamkeit* (vol. i., 3d ed., 1901; vol. ii. 1902).

HOERNLE, hẽrn'le, Rudolf Augustus Frederic (1841—). An English Orientalist and prominent authority on Indian antiquities and languages. He was born at Agra, in East India; was educated at Esslingen, Stuttgart, Basel, and Tübingen; became a missionary of the English Church at Mirat in 1865; and taught for four yeras at the Jay Narain's College in Benares. He entered the governmental educational service in 1881, after several years as principal of the mission college at Calcutta, and until 1899, when he retired and returned to England, was principal of the Calcutta Madrasah. He edited: *Chaṇḍa's Grammar of the Ancient Prākṛit* (1880); *The Prithirāj Rāsan* (1886); and *The Uvāsagadasāo with Abhayadeva's Commentary* (1888-90); translated *The Suśrutasamhitā, or the Hindu System of Medicine* (1897 sqq.); and wrote, among other linguistic works of considerable importance, *A Comparative Grammar of the Gaudian Languages* (1880), and with Grierson, the incomplete *Comparative Dictionary of the Behāri Language* (1885 sqq.).

HOËVELL, hōō'vĕl, Walter Robert van, Baron (1812-79). A Dutch author and colonial statesman, born at Deventer. He studied theology at Groningen, and in 1836 went to Bavaria, where in the following year, he founded the *Tijdschrift van Nederlandsch-Indië*. For the emancipation of the slaves and for the spread of Christianity in the Dutch Indies van Hoëvell accomplished much, especially by his writings. He also edited and translated various Malaysian poems, among which *Sjair Bidasari* (1843) deserves mention. But his greatest work was in colonial politics. From 1849 to 1854 he published *Reis over Java, Madura en Bali*, which joined a keen criticism of governmental methods of the time with a brilliant description of East Indian scenery and life. Returning to Holland in 1848, he was elected to the House of Deputies, where for thirteen years he was leader of the Liberal Colonial Party. His parliamentary speeches delivered during this period (published 1862-66) are models. Van Hoëvell was named Councilor of State in 1862. His sketches, *Uit het Indische leven* (1860, 2d ed., 1865), met with immense success, and in 1868 were published in German.

HOEVEN, hōō'ven (Hoof'en), Jan van der (1802-68). A distinguished Dutch naturalist. He was born in Rotterdam; studied medicine and natural history at Leyden and Paris; became professor of zoölogy at Leyden in 1826, and held this position until his death. His most important work is his *Handbock der Dierkunde* (2 vols., 1827-33). An English translation, by Professor Clark of Cambridge, under the title *Handbook of Zoölogy*, was issued, with important additions by both the author and the editor, in 1856-58.—His elder brother, Cornelis Pruys (1792-1871), was professor of medicine in the University of Leyden, and author of several important works, including: *De Historia Medicinæ* (1842); *De Historia Morborum* (1846); and *De Historia Medicamentorum* (1847).

HOF, hōf. A town of Bavaria, situated on the Saale, in Upper Franconia, 32 miles northeast of Bayreuth (Map: Germany, D 3). It has an attractive thirteenth-century church, recently restored, with some interesting contents, and an old Gothic Rathaus. There are a gymnasium, opened in 1546, and a hospital dating from 1260. The numerous textile manufacturing establishments produce chiefly cotton and woolen goods. There are also exported machinery and other iron and steel products, chemicals, vinegar, pottery, and leather. Hof, with its industrial activities, is well equipped with commercial unions and banks. It has electric lights, water-works, and canal communication. The town was founded about the end of the eleventh century. The original name was Regnitzhof. It was almost destroyed by fire in 1823. Population, in 1890, 24,455; in 1900, 32,781; mostly Protestants.

HOFDIJK, hōf'dīk, Willem Jacobszoon (1816-88). A Dutch poet and author, born at Alkmaar. His first work, a romantic poem, *Rosamunde* (1839), attracted the attention of van Lennep, who obtained for him a clerk's position in the Government offices at Alkmaar. Afterwards he taught Dutch history and literature in the gymnasium at Amsterdam. His works, which are in verse and prose, include the studies in Dutch history: *Geschiedenis der Nederlandsche Letterkunde* (1856); *Historische Landschappen* (1856); *Geschiedenis des Nederlandschen Volks* (1865-72); *Willem Frederik Hendrik, Prins der Nederlanden* (1880); and the poems: *De Bruidsdans* (1842); *De Jonker van Brederode* (1849); and *Kennemerland, Balladen* (1850-52). He also wrote some poetical dramas, without much success.

HOFER, hō'fẽr, Andreas (1767-1810). A patriot leader of Tyrol. He was born at Sankt Leonhard, in the valley of Passeier, November 22, 1767. His father was landlord of the inn 'Am Sand,' and the son carried on the business, becoming known as the 'Sandwirt.' In 1796 Hofer led a body of sharpshooters against the French on Lake Garda; in 1805 he fought against Ney in the valley of Passeier, and after Tyrol had been abandoned to France by the Peace of Pressburg he was chosen as one of the secret deputation which was sent to Vienna to represent to the Archduke John the sufferings of the people, and their wish to be reunited to Austria. But Austria was powerless, and in virtue of Napoleon's decree Tyrol was made part of Bavaria. The patriots, however, did not lose heart, and at the desire of the Archduke, Baron von Hormayr prepared for them a plan of insurrection. The rising took place in 1809, on the renewal of war between Napoleon and Austria. On April 11th Hofer defeated the Bavarian allies of France at Sterzing, and after they had rallied during the early part of May, he beat them again in the neighborhood of Innsbruck, forcing them to evacuate Tyrol. Napoleon, however, dispatched three armies to subdue the rebellious peasantry, who had been abandoned by the Austrians by the armistice of Znaim (July 12, 1809). At first Hofer concealed himself in the valley of Passeier; but later speedily renewed the defense of Tyrol, and defeated the combined French and Bavarian forces under Lefebvre at Berg Isel (August 13, 1809), driving them from the country. For two months Tyrol was free, and Hofer acted as head of the Government, but the Treaty of Vienna (October 14, 1809) resulted in a fresh invasion. The French and Bavarians poured into the country, and, after an heroic struggle, Hofer was obliged to take refuge in the mountains. Two months later (January 28, 1810) he was betrayed into the hands of the French, conveyed to Mantua, and there shot, by order of Napoleon, after a summary trial. His family were indemnified for the loss of their property by the Emperor of Austria in 1818, and his son was ennobled. Hofer has been made the hero of tragedies by Auerbach and Immermann, and there are numerous patriotic songs about him in Tyrol. Consult: Hormayr, *Das Land Tyrol und der Tyrolerkrieg von 1809* (Leipzig, 1845); Heigel, *Andreas Hofer* (Munich, 1874); Egger, *Geschichte Tyrols* (Innsbruck, 1870-80); Stampfer, *Sandwirt Andreas Hofer* (Freiburg, 1891).

HOFF, hōf, Jakobus Hendrikus van 't (1852 —). A Dutch chemist and coeditor of the *Zeitschrift für physikalische Chemie*, born at Rotterdam. He studied at the universities of Delft, Leyden, Bonn, Paris, and Utrecht, and in 1876 became a teacher in the veterinary school at Utrecht. Two years later he was made a professor at the University of Amsterdam, and in 1896 was called to the University of Berlin. He was the founder of stereochemistry, and one of the most prominent investigators in the new physical chemistry. Among his publications are: *La chimie dans l'espace* (1875), translated by Arnold Eiloart as *The Arrangement of Atoms in Space* (1898); *Vorlesungen über theoretische und physikalische Chemie* (1898-1900; vol. i., 2d ed. 1901), translated by R. A. Lehfeld under the title *Lectures on Theoretical and Physical Chemistry* (1898-99); and *Acht Vorträge über physikalische Chemie gehalten auf Einladung der Universität Chicago* (1902). In 1901 he received the Nobel prize for the most important contribution to chemistry.

HÖFFDING, hēf'dĭng, Harald (1843—). A Danish philosopher, born and educated in Copenhagen. He was a school-teacher between 1861 and 1871, in the latter year became instructor, and in 1883 professor in the University of Copenhagen. He was early influenced by Kierkegaard and held to a distinction between knowledge and belief; but later became a positivist, though he joins with the views of that school the methods of critical philosophy and the results of psychological study. In ethics he is a utilitarian of a moderate type, not holding that self-interest is the motive of action. His principal works are: *Den engelske Filosofi i vor Tid* (1874); *Etik* (last ed. 1879); *Psychologi i Omrids paa Grundlag of Erfaring* (last ed. 1892); *Formal Logik til Brug ved Forelæsninger* (last ed. 1890); *Psykologiske Undersogelser* (1889); *Kontinuiteten i Kants filosofiske Udviklingsgang* (1893); *Den nyere Filosofis Historie* (1894); *Rousseau und seine Philosophie* (1901); *Det psykologiske Grundlag for logiske Domme* (1899); *Religionsfilosofi* (1901); and *Mindre Arbejder* (1899).

HOFF'MAN, Charles Fenno (1806-84). An American poet and novelist, born in New York City. In early youth he had his leg crushed and amputated, but was not deterred thereby from athletics and an open-air life. Educated, but not graduated, at Columbia College, he was admitted to the bar at twenty-one and practiced three years, after which he devoted himself to literature. In 1833 he established the *Knickerbocker Magazine*, but soon gave it up and became editor of the *American Monthly*, which he conducted for several years. Afterwards he edited for short periods the *Mirror* and the *Literary World*. His first book was *A Winter in the West* (1835), which was followed by *Wild Scenes in Forest and Prairie* (1837)—both based upon actual experiences in search of health. He now wrote a few novels, the most important being *Greyslaer* (1840), founded upon the murder of Colonel Sharpe by Beauchamp, a theme which a little later attracted Simms (q.v.). But his fame rested chiefly upon his poems, first collected in *The Vigil of Faith* (1842), and especially his songs, which were once deservedly popular. Among them may be named "Rosalie Clare" and "Monterey." A complete edition of his poems appeared in 1873. In 1849 he became insane, and for the remainder of his life was confined in an asylum.

HOFFMAN, David (1784-1854). An American lawyer and author. He was professor of law in the University of Maryland from 1817 to 1836; traveled much abroad, and received honorary degrees from Oxford and Göttingen. Among his publications are: *A Course of Legal Studies* (1817); *Legal Outlines* (1836); *Miscellaneous Thoughts on Men, Manners, and Things*, by 'Anthony Grumbler' (1837); and *Chronicles Selected from the Originals of Cartaphilus, the Wandering Jew* (1853).

HOFFMAN, Eugene Augustus (1829-1902). An American clergyman of the Protestant Episcopal Church. He was born in New York City, and was educated at Rutgers and Harvard Colleges and at the General Theological Seminary. He was rector successively of Christ Church, Elizabeth, N. J.; Saint Mary's Church, Burlington, N. J.; Grace Church, Brooklyn Heights; and Saint Mark's Church, Philadelphia. In 1879 he was appointed dean of the General Theological Seminary, New York, and in connection with his family heavily endowed that institution. Dr. Hoffman built Christ Church and rectory at Elizabeth, and churches at Milburn and Woodbridge, N. J. He wrote *Free Churches* (1858), and *The Eucharistic Week* (1859 and 1893).

HOFFMAN, Richard (1831—). An American pianist, composer, and teacher. He was born in Manchester, Lancashire, England, but after his sixteenth year resided in New York City. His earliest instruction was received from his father, and subsequently from Meyer, Pleyel, Moscheles, Rubinstein, Thalberg, Döbler, and Liszt. Within a year of his arrival in America he made a tour of the country, and later accompanied Jenny Lind on her tours. He was an exceedingly popular concert pianist, and played with Gottschalk, and afterwards with Von Bülow (New York, 1875). He settled down to teaching, and has been one of the most important factors in American musical life. His compositions consist of pianoforte music, part songs, ballads, anthems, and Church music generally.

HOFFMAN, Walter James (1846-99). An American ethnologist. He was born at Weidasville, Pa., studied medicine at Jefferson College, Philadelphia, and practiced it in Reading, Pa., till 1870, when he went to the Franco-Prussian War as a surgeon with the German Army. On his return he took a similar position with the United States troops, and thus obtained opportunities for natural history researches in Arizona, Nevada, and Dakota. In 1877 Hoffman was attached to the Geological Survey, and two years afterwards became assistant in the Bureau of Ethnology at its formation.

HOFFMAN, or, The Revenge for a Father. A tragedy by Henry Chettle, performed in 1602; the only play written wholly by this author that has been preserved. It exists in a very corrupt quarto, printed in 1631 without the author's name.

HOFFMANN, hŏf'mȧn, August Heinrich, called Hoffmann von Fallersleben, fôn fäl'ẽrs-lā'ben (1798-1874). A German poet, philologist, and literary historian, born at Fallersleben. He was educated at Göttingen and Bonn, and from 1823 to 1838 was librarian at the University of Breslau, where he was also professor from 1830 till his dismissal (1842) for his *Unpolitische Lieder* (1841-42). He was restored to his rights as a Prussian citizen in 1848, having passed the intervening years in Mecklenburg. He married in 1849 and afterwards lived at Bingerbrück, Neuwied, and Weimar, where he was an editor of the *Weimarisches Jahrbuch*. From 1860 till his death he was librarian of the Duke of Ratibor. Popular at first as a liberal political poet, he is cherished still for the ease, simplicity, and grace of songs of common life, for many of which he also composed melodies. Hoffmann was a diligent editor of early German classics (*Reineke Vos, Monumenta Elnonensia, Theophilus*), made valuable contributions to philology now of antiquarian interest only, and to literary history. In 1868-70 Hoffmann published *Mein Leben*, an autobiography in six volumes. Hoffmann's *Works* are still uncollected, but the *Poems* (incomplete) have been often reëdited. His *Briefe an Ferdinand Wolf* were published in 1874. There is a *Life* by Wagner (Vienna and Dresden, 1869). Consult also Kreyenberg, in *Preussische Jahrbücher* (Berlin, 1891).

HOFFMANN, Ernst Theodor Amadeus (originally Wilhelm) (1776-1822). An eccentric German romantic novelist of cosmopolitan reputation and influence, born at Königsberg. His foremost characteristic is his wayward yet keen fancy, suggesting at once Hawthorne and Poe. He dealt by preference with the grotesque, startling, and marvelous, until toward the close of his life morbidity verged on madness. After a joyless childhood, he prepared for the law, let his wit run away with his prudence in some witty caricatures, and finding his career thus blocked, suffered from penury and dissipation. He eked out a living by scene and portrait painting and musical composition and criticism in Posen, Warsaw, Bamberg, Leipzig, Dresden, and Berlin, where in 1816 he became councilor of the Court of Appeals. For short intervals he was manager and musical director also. His first book was a collection of musical criticisms with illustrations, *Phantasiestücke in Callots Manier* (1814). In 1816 appeared *Die Elixire des Teufels*, which, with *Lebensansichten des Katers Murr* (1820-22), is the most famous of his works. Other noteworthy volumes are *Die Serapionsbrüder* (1819-21) and

Nachtstücke (1817). All are alike characterized by a lyric swing and an erratic imagination that is mentally disquieting and yet blended with shrewd satire, wit, and even wisdom. He died of disease induced by dissipation, his mind at times clear, and clinging tenaciously to a life that ebbed inch by inch away. Hoffmann's *Works* are in fifteen volumes (1879-83). Of the more popular, there are many editions. The *Elixire des Teufels* has been translated into English (1824), also *Der goldene Topf* (The Golden Pot), one of the *Phantasiestücke*, by Carlyle in his *German Romance* (Edinburgh, 1827), with a biographical sketch. Other translations are by Gillies (London, 1826); Bealby (New York, 1885); and Ewing (London, 1886). Consult: Hitzig, *Hoffmanns Leben und Nachlass* (Stuttgart, 1839), and *Erinnerungen*, by Funck (Leipzig, 1836).

HOFFMANN, Friedrich (1660-1742). A German physician, one of the most celebrated of the eighteenth century. He was born at Halle, and received his medical degree in 1681 at Jena. He then studied chemistry at Erfurt, under Kaspar Cramer; practiced at Minden and Halberstadt with great success, and was professor of medicine in the University of Halle from 1693 to 1742. In 1708 he became physician to the King of Prussia at Berlin, and subsequently enjoyed a European reputation second only to that of Boerhaave. His name is perpetuated in the title Hoffmann's anodyne. (See Ether.) His greatest work was *Medicina Rationalis Systematica* (1718-40); *Opera Omnia Physico-Medica Denuo Revisa, Correcta et Aucta* (1740) and *Medicini Consultatoria* (1721-39) were also celebrated, together with the *Opuscula*, published after his death and reprinted at Venice in seventeen volumes, in 1745, and subsequently at Naples.

HOFFMANN, Gustav (known as Graben-Hoffmann) (1820-1900). A German composer, born at Bnin, near Posen. He was the pupil of Stümer in Berlin, and afterwards of Hauptmann at Leipzig in singing, and acquired a reputation in barytone parts in concert and oratorio. He taught vocal music, and composed nearly a hundred books of songs and choral music, besides publishing several text-books on voice-training. His best-known song is "Fünfmalhunderttausend Teufel." In 1885 he settled at Potsdam, where he founded a singing-school for women.

HOFFMANN, Hans (1848—). A German novelist, born in Stettin. He studied at the universities of Bonn, Berlin, and Halle, and made a long visit to Italy and Greece. He is one of the most gifted of the modern German novelists, and unites with an uncommon talent for vivid descriptions of landscapes a poetical and delightful humor. Among his works are: *Iwan der Schreckliche und sein Hund* (1889); *Von Frühling zu Frühling* (1889; 3d ed. 1898); *Geschichten aus Hinterpommern* (1891; 2d ed. 1894); and *Irrende Mutterliebe* (1900).

HOFFMANN, or **HOFFMANN-DONNER**, dŏn′ẽr, Heinrich (1809-94). A German humorous poet, born in Frankfort-on-the-Main. At his marriage he added his wife's name (Donner) to his own. He studied at the universities of Heidelberg, Halle, and Paris; then became a teacher of anatomy in the Senckenberg Institution in Frankfort-on-the-Main, and from 1851 till 1889 was directing physician of the municipal insane asylum. He wrote on medical subjects, but is far better known through his children's books, which he illustrated himself. The most famous of these, *Struwwelpeter* (1845), has gone through several hundred editions, and has been widely translated. He also published *König Nussknacker* and a volume of poems, *Auf heitern Pfaden* (1873).

HOFFORY, hŏ′fō-rē, (John Peter) Julius (1855-97). A Danish-German philologist, phonetician, and Germanic scholar, born at Aarhus. He was educated at Copenhagen and Berlin. In 1886 he was made professor of Norse philology and phonetics at the University of Berlin. He wrote: *Eddastudien* (1889); "Phonetische Streitfragen," in the *Zeitschrift für vergleichende Sprachforschung*, vol. xxiii.; and *Professor Sievers und die Principien der Sprachphysiologie* (1884), both attacks on Sievers. He edited and translated into German some of Holberg's comedies under the title of *Dänische Schaubühne* (1885-87), and translated other Danish writings in *Nordische Bibliothek* (1889-91). He did much toward the introduction of Ibsen in Germany.

HOFHAIMER, hŏf′hī′mẽr, or **HOFHAINER**, Paulus von (1459-1537). An Austrian composer, born in Salzburg. He was an excellent organist, and filled the position of Court organist and composer in Vienna. He received numerous honors, and was especially distinguished as a teacher. As a composer he ranked among the foremost of his time. His best work was *Harmoniæ Poeticæ* (1839, republished 1868), consisting of Latin poems set for four voices. In addition, he composed many German songs.

HOFHUF, hō-fōōf′. See El-Hofuf.

HÖFLER, hẽf′lẽr, Karl Adolf Konstantin von (1811-97). A German historian. He was born at Memmingen, and studied at the universities of Munich and Göttingen. For two years (1834-36) he was in Rome and Florence, making historical researches. When he returned to Munich he directed the *Münchener Zeitung*, the official journal of Bavaria. Three years afterwards he was made a professor at the university there. He became involved in the political troubles of Bavaria, and the publication of his *Konkordat und Konstitutionseid der Katholiken in Bayern* (1847) lost him his Munich chair; but, after being archivist at Bamberg for a time, he was made professor of history in the University of Prague (1851). In the controversy between the Czechs and the Germans, Höfler sided conspicuously with the Czechs, and in 1872 he was called into the Austrian House of Peers. His numerous historical publications include: *Die deutschen Päpste* (1839); *Lehrbuch der allgemeinen Geschichte* (1850-56); *Papst Adrian VI.* (1880); *Monumenta Hispanica* (1881-82); and *Die Aeræ der Bastarden am Schlusse des Mittelalters* (1891).

HOFMANN, hŏf′mȧn, August Wilhelm von (1818-92). A distinguished German chemist, born at Giessen. After obtaining the degree of doctor of philosophy, he became assistant to Liebig in the Giessen laboratory, and in 1845 became professor of chemistry in the University of Bonn. In the same year the Royal College of Chemistry was established in London, and Hofmann was recommended by Liebig as highly qualified for the post of superintendent to the new institution. This college, which subsequently became part of the Royal School of Mines, owes much of its high reputation to Hofmann's activity. On the promotion of Thomas Graham from the post of chemist to the mint to the office of master of that institution, Hofmann was appointed his successor. In 1861 he was elected president of the London Chemical Society. In 1863 Hofmann accepted the chair of chemistry in the University of Berlin, and in 1868 founded the German Chemical Society. He was ennobled in 1888. He served as judge at several industrial expositions, of which he published admirable accounts, and was a member of many scientific bodies, at home and abroad. Hofmann was one of the greatest chemists of the nineteenth century.

The results of his brilliant researches have formed entire departments in organic chemistry, and have had an important influence on the development of chemical theory. He investigated the organic bases obtained from coal-tar, and discovered a new and important class of compounds which are derived from ammonia by the substitution of organic radicals for hydrogen atoms. Among his most important discoveries is that of aniline among the products of destructive distillation of bituminous coal, and the discovery of methods for the artificial preparation of beautiful coloring substances from aniline. He obtained the colorless base known as *rosanilin* and its colored salts, such as *fuchsin, dahlia* (*'Hofmann's violet'*), etc., which are the most important of the colors derived from aniline. These discoveries have contributed greatly to the development of the color industry, and have practically revolutionized the art of dyeing. Among his contributions to physical chemistry may be mentioned his method of determining the vapor densities of chemical substances for the purpose of obtaining their molecular weights, and a method of demonstrating the dissociation of gases, such as carbonic-acid gas and water-vapor, by the action of electric sparks. Hofmann was a brilliant teacher, and his *Introduction to Modern Chemistry* (1865, and several later editions) has brought about important reforms in the methods of teaching chemistry. He also wrote: *A Handbook of Organic Analysis* (1853); *The Life Work of Liebig in Experimental and Philosophic Chemistry* (1876); *Zur Erinnerung an vorangegangene Freunde* (1889), etc. Consult: Volhard and Fischer, *August Wilhelm von Hofmann. Ein Lebensbild, im Auftrage der Deutschen Chemischen Gesellschaft* (Berlin, 1902).

HOFMANN, Franz Adolf (1843—). A German hygienist. He was born in Munich, studied medicine there, and was assistant in the physiological institute of the university until 1872, when he went to Leipzig as head of the university laboratory of pathological chemistry. Six years afterwards Hofmann was appointed to the management of the hygienic institute of the same university. An editor of the *Archiv für Hygiene*, he contributed to that journal, to the *Zeitschrift für Biologie*, and to the *Vierteljahrschrift für öffentliche Gesundheitspflege*, on pathological chemistry, on the properties of subterraneous waters, and on disinfection, refrigeration, and the preservation of foods, especially meats.

HOFMANN, Heinrich (1842-1902). A German composer, born in Berlin. As a pupil of Kullak's Akademie he studied under Grell, Dehn, and Wüerst, and became a well-known pianist. In 1869 his opera, *Cartouche*, was produced in Berlin, and thereafter he devoted himself entirely to composition. Hofmann was considered one of the foremost of contemporary composers, and was elected a member of the Berlin Royal Academy of Arts. His compositions include: an *Ungarische Suite* (1873); the symphony *Frithjof* (1874); the operas *Der Matador* (1872), *Armin* (1872), *Wilhelm von Oranien* (1882), *Lully* (1889); the secular oratorio *Prometheus* (1896); numerous choral works, cantatas, and songs; and a series of exquisite pianoforte duets.

HOFMANN, Heinrich (1824—). A German historical painter, born in Darmstadt. He was a pupil of Theodor Hildebrandt and Schadow at Düsseldorf and of the Antwerp Academy. After visiting Italy in 1854-58, where he came under the influence of Cornelius, and practising in different German cities, he settled, in 1862, at Dresden, where he became professor at the Academy. Although his subjects are drawn from the entire domain of literature and mythology, his extensively engraved scenes from the life of Christ are most widely known. Among these are: "Christ Taken Prisoner" (1858, Darmstadt), "The Adulteress before Christ" (1868, Dresden), "Christ's Sermon on Lake Gennesaret" (1875, Berlin), and "Christ in the Temple" (1882, Dresden). In 1878-79 he decorated the ceiling of the vestibule in the Dresden Theatre with "Apotheosis of the Heroes of the Greek Drama." In color, composition, and drawing his paintings are good, though not of the first rank; they owe their popularity to his ideal conception of biblical events.

HOFMANN, Johann Christian Konrad von (1810-77). A German Lutheran theologian and historian, born in Nuremberg. He studied history and theology at the universities of Erlangen and Berlin, and in 1833 was appointed a teacher in the gymnasium at Erlangen. Two years later he became a tutor in the theological faculty of the university, and in 1841 professor extraordinarius. The next year he accepted a call as full professor to Rostock, but in 1845 returned to Erlangen. In 1857 he was ennobled. He was the head of the so-called Erlangen school, which developed the theological ideas of Bengel, and in the end conformed in all essential respects with the doctrines of the Lutheran Church. As a member of the Second Chamber of the Bavarian Legislature he labored for the union of Germany, and was, despite his clerical conservatism, a member of the Progressist Party. His writings include: *Lehrbuch der Weltgeschichte* (2d ed. 1843); *Weissagung und Erfüllung* (2d ed., 3 vols., 1857-60); *Die Heilige Schrift Neuen Testaments, zusammenhängend untersucht* (1862-86, the latter part edited by Vlock); and *Der Schriftbeweis* (2d ed. 1857-60). Consult Grau, *Johann Christian Konrad von Hofmann. Erinnerungen* (Gütersloh, 1879).

HOFMANN, Josef (1877—). A celebrated Polish concert pianist, born in Cracow, Galicia. His father was a leading musician of Warsaw, in which city he held the position of professor of harmony and composition at the conservatory, and also the directorship of the opera. Josef studied with his father until he was fifteen years of age, after which he spent two years with Rubinstein. As a child he was one of the most remarkable musical prodigies ever known; at the age of six years he had made his public début, and by the time he was nine had toured Conti-

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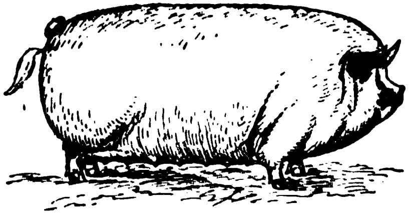
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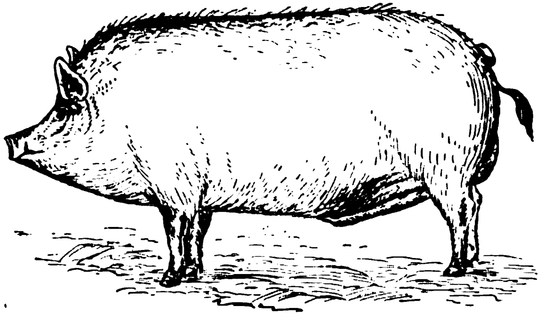

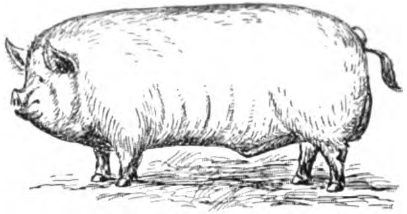
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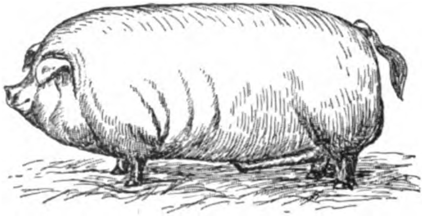

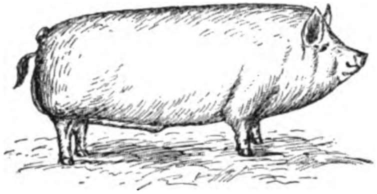
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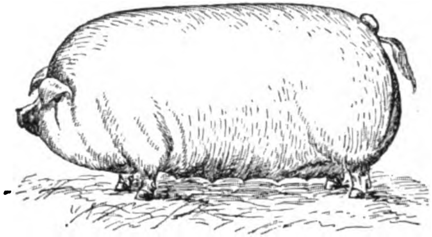


1. KANSAS BERKSHIRE SOW
2. TAMWORTH BOAR
3. LARGE YORKSHIRE OR "WHITE"
4. CHESTER WHITE BOAR
5. KANSAS ESSEX BOAR
6. KANSAS POLAND-CHINA SOW

nental Europe and Great Britain, and in 1887-88 he visited America. On the conclusion of the last-named tour he went into retirement for further study and preparation, and in 1894 made his reappearance as a full-fledged concert virtuoso at Dresden, and subsequently toured every civilized country. On his reappearance in New York in 1901 he showed a vastly improved technique and great interpretative ability. He has composed several attractive numbers for the piano.

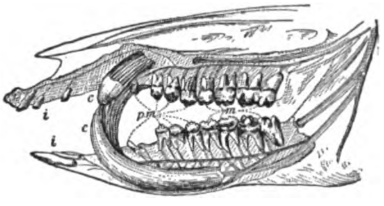
HOFMANN, KONRAD (1819-90). A German philologist, born near Bamberg. He studied medicine at Munich and Erlangen, and philology at Munich, Leipzig, Berlin, and Paris. In 1852 he was put in charge of the materials gathered by Schmeller in the library of Munich. In the following year he succeeded Schmeller as professor of Germanic philology, assuming in 1869 also the chair of Romance philology. Most of his writings were for journals, especially the publications of the Munich Academy, *Romanische Forschungen,* and Pfeiffer's *Germania.* His other works are: Editions of the *Hildebrandlied* (with Vollmar, 1850); *Amis et Amiles, Jourdain de Blaivies* (last ed. 1882); *Primavera y Flor de Romances* (with Wolf, 1856); *Karls des Grossen Pilgerfahrt* (1866); *Joufrois* (1880); Lutwin's *Adam und Eva* (with Meyer, 1881); *Chanson de Roland* (not published); and the critical works: *Ueber die Gründung der Wissenschaft altdeutscher Sprache und Litteratur* (1857), and *Zur Textkritik der Nibelungen* (1872).

HOFMANNSWALDAU, hŏf'mäns-väl'dou, CHRISTIAN HOFMANN VON (1617-79). A German poet, born in Breslau; the chief representative of the so-called second Silesian school. He studied at Leyden, and then traveled through the Netherlands, England, France, and Italy. On his return, and before he had reached the required age, he was made a member of the Breslau city council. His poetry was greatly influenced by the Italians Guarini and Marino, and departed more and more from the somewhat insipid and tasteless style of the previously authoritative Martin Opitz (q.v.). Witty and endowed with considerable literary skill, he was much admired; his love lyrics were often imitated, and many editions of them were published. Consult Ettlinger, *Christian Hofmann von Hofmannswaldau* (Halle, 1891).

HOFMEISTER, hŏf'mī-stẽr, WILHELM (1824-77). A German botanist, born at Leipzig. He became professor of botany at Heidelberg in 1863, and at Tübingen in 1872. His researches in botany resulted in contributions of the greatest importance, especially to the department dealing with the reproduction of plants. He published *Die Entstehung des Embryo der Phanerogamen* (1849) and *Vergleichende Untersuchungen höherer Kryptogamen und der Koniferen* (1851).

HOFSTEDE DE GROOT, hŏf'stā-de de grōt, PETRUS (1802-86). A Dutch theologian and reformer, born at Leer in East Friesland. In 1826 he became pastor at Ulrum, and in 1829 professor in and preacher to the university at Groningen. He was the head of the so-called Groningen school, the members of which style themselves the Evangelicals and form a middle Church party between the moderns and the orthodox. The party organ was the *Waarheid en Liefde,* of which Hofstede was an editor. His writings include: *Opvoeding der Menschheid* (2d ed. 1855); *Institutio Theologiæ Naturalis* (4th ed. 1861); *Die Groninger Theologen* (1854); *Over de evangelisch-catholieke godgeleerdheid als de godgeleerdheid der toekomst* (1856); *Die moderne Theologie in den Niederlanden* (1870). Consult Heerspink, *Dr. Petrus Hofstedes leven en werken* (Groningen, 1897).

HOG, THE DOMESTIC (probably from *hog, hag,* to cut, Icel. *hoggva,* Swed. *hugga,* AS. *hēawan,* OHG. *houwan,* Ger. *hauen,* to hew; connected with OChurch Slav. *kovati,* Lith. *káuti,* to strike, to forge; referring ordinarily to a castrated boar). All the known breeds of domestic swine (see SWINE, for the general natural history of the race) may be divided into two groups: The European hog (*Sus scrofa*), which is sprung from and resembles the wild boar; and the Asiatic pigs, regarded as descended from the Indian wild boar (*Sus cristatus*). The common hog (*Sus scrofa*) appears to be a native of most parts of Europe and Asia, and domesticated swine were found by the first navigators in many islands of the southern seas. Although the use of its flesh was prohibited to the Jews, and the prohibition has been adopted in the Mohammedan law, it constitutes a large part of the food of many nations. The fecundity of the hog is great; with proper treatment, it will produce two litters annually, generally of four to eight pigs each, although sometimes there are as many as fourteen in a litter. The period of gestation is usually 16 weeks. Great quantities of the flesh and fat are consumed in various forms as pork, fresh or salted, bacon, ham, lard, and so on. Brawn is an English luxury. Hog skin is made into leather, which is highly esteemed for saddles. The bristles are much used for brush-making.



DENTITION OF THE WILD BOAR.

Right upper and lower jaws, with their teeth and their nerves, exposed from the inside: *i, i,* incisors; *c, c,* canines (tusks); *pm,* premolars; *m,* molars.

BREEDS. Numerous breeds of the domestic hog have resulted from selection and crossing and from conditions of environment favorable to improvement. Apparently there were two original or native breeds in Great Britain, the old English hog and a breed found in the Highlands of Scotland. From these our modern improved breeds have been developed by crossing the native breeds with foreign hogs, principally the Chinese and Neapolitans. The modern white breeds, with fine bone, thin skin, short legs, a tendency to fatten at an early age, take these qualities from the Chinese hog; while the black breeds, of which the Essex is a type, get their qualities from the Neapolitan stock.

The *Yorkshire* is the principal of the English white breeds and is divided into three subvarieties, the Large Whites, or Large Yorkshires, the Middle Whites, represented by the Cheshires, and the Small Whites or Small Yorkshires, which are considered the smallest and finest of the white breeds. They mature early and fatten quickly.

The Large Whites are characterized by immense size, although the best are rather fine boned and not coarse. The Yorkshires are very popular in England, and white swine generally are preferred in that country. It is said that from this source came the American breed of Chester Whites, which was originated in Chester County, Pa. Pigs of this breed are among the largest, and individuals have attained a weight of 1300 pounds. They are said to be lacking in hardiness and to have a tendency to degenerate under careless treatment or neglect.

The *Berkshires* are probably the most universally popular and widely disseminated of all the breeds. This breed is of English origin, and takes its name from the county whence it came. It is of large size, black in color with white on the face, and occasional splashes elsewhere, and fattens readily at any age. Great improvement has been made in its size and symmetry in recent years. The quality of the pork is unexcelled.

The *Poland-Chinas* divide honors with the Berkshires in the great pork-producing sections of the United States. This is also a black breed, and is a purely American one, originating in Ohio. It is not generally believed that any Polish cross was ever introduced in its development, in spite of its name. As now bred, the Poland-Chinas are similar to the Berkshires, but show rather more white in their markings. They are among the largest of hogs, but have been much improved in fineness of bone, early maturity, and tendency to fatten at an early age.

The *Jersey Reds* or *Durocs* are a breed of unknown origin, which has long been quite extensively bred in New Jersey. They are also known as Red Berkshires. They are rather coarse, but are considered much hardier than the finer boned breeds. The *Tamworth* is a large, coarse, 'leggy' hog, of a dark chestnut color, more or less spotted with black. This animal has been widely exploited as a bacon hog. The *Victorias* are a white breed of medium size, not widely raised in the United States; and the *Essex* is a black English breed, classed among the smaller breeds. It has not become popular in the United States. Record books or registers are published in the United States for the Berkshire, Poland-China, Yorkshire, Chester White, and Duroc-Jersey breeds.

Care and Treatment. Although hogs are raised to some extent in every section of the country, the great pork-producing section is in the Mississippi Valley, where corn is abundant and cheap. The northern part of this valley is said to be the greatest hog-raising section in the world. The hogs are commonly pastured during the earlier stages of growth. Frequently a herd of swine are put with steers which are being fed whole corn, and the hogs feed upon the corn voided in the manure. Alfalfa pasturage is used for hogs in some sections. In the South, cowpeas, peanuts, chufas, and a variety of other crops are grown for hog-pasture. Corn is the great hog feed of the middle West; sometimes it is ground, but it is largely fed on the ear. As corn contains only a small percentage of ash, the hogs fed upon it exclusively become weak-boned, and can hardly walk about. This is corrected by giving wood-ashes, which they eat greedily. Skim milk and buttermilk from creameries constitute excellent food for pigs of all ages; and if corn-meal is added, a pork of the finest quality is obtained. The large, over-fattened hog, weighing 400 or 500 pounds, has given way to a quickly maturing hog of from 200 to 300 pounds. This animal is produced more economically and is preferred by the packing houses. The gains in proportion to the food eaten diminish as the animal grows, and experiments have shown that it is most profitable to market the hogs when they have reached 200 or 250 pounds. Packers prefer a hog weighing about 250 pounds. See Pork; Swine.

Bibliography. Consult: Long, *The Book of the Pig* (London, 1889); Coburn, *Swine Husbandry* (New York, 1888); Harris, *On the Pig* (New York, latest ed., 1896); Spencer, *Pigs, Breeds and Management* (London, 1897); Wallace, *Farm Live Stock of Great Britain* (Edinburgh, 1889).

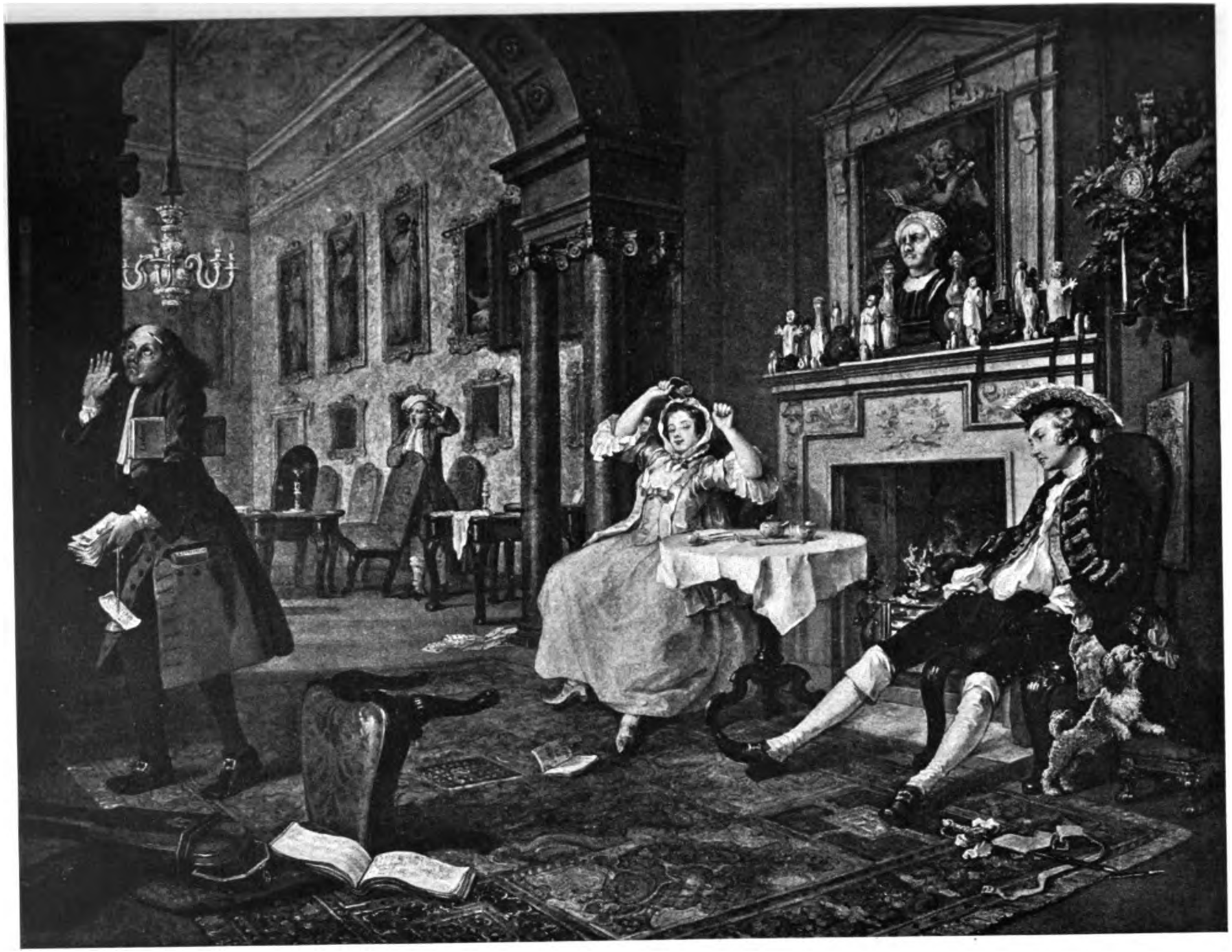
HOG (so called as resembling in outline the back of a hog). This nautical term implies the opposite of *sag*. A ship is *hogged* when through weakness her ends droop in such a manner as to cause her keel to curve upward amidships. In lightly built or shallow vessels a tendency to *hog* is prevented by a truss frame arranged to support the ends and called the hog-frame. Most wood-built and many iron paddle-wheel river steamers have such frames rising well above the hull, and sometimes above the deck-houses. Instead of a framework extending from end to end, it may be located only amidships, and the strain transmitted to it by *hog-chains* extending to the ends.

HOG-APE. The mandrill. See Baboon.

HOG-APPLE. See Podophyllum.

HOGARTH, hō′gärth, George (1783-1870). A Scottish journalist and musical critic, born in Edinburgh. He studied law and music there, played the violoncello, wrote criticisms for the *Courant*, and associated with Sir Walter Scott's clique. When about fifty years of age, he went to London to live, and became a member of the editorial staff of the *Morning Chronicle*, then of the *Daily Telegraph* (1846-66), of which his son-in-law, Charles Dickens, was editor. The novelist was indebted to the journalist for the insertion of some of his earlier work in the *Evening Chronicle*. He was musical critic of the *Illustrated London News*, and also secretary of the Philharmonic Society (1850-64), and wrote its history, as well as a general *Musical History, Bibliography and Criticism* (1835); *Memoirs of the Musical Drama* (2 vols., 1838; 2d ed. 1851); and other works on his specialty, besides editing and harmonizing collections of hymns and songs.

HOGARTH, William (1697-1764). An English painter and engraver, born in London, November 10, 1697. His father was an unsuccessful schoolmaster, who was also a hack writer and corrector for the press. At the age of seventeen, Hogarth was apprenticed to a silversmith for whom he made designs for plate, which are now much prized by collectors. In 1718 he entered business on his own account, and besides engraving arms and shop bills, he began to design copper plates for the booksellers. During the years 1721-26 he designed a number of engravings, the most important of which were "Masquerades and Operas" (1724), which struck the keynote of his future satire, and his illustrations to Butler's *Hudibras*, which brought him into public notice. At first Hogarth's ambition was



WILLIAM HOGARTH
"AFTER THE MARRIAGE" (FROM "MARRIAGE À LA MODE")
FROM THE ORIGINAL IN THE NATIONAL GALLERY LONDON

to be a line-engraver, but about 1724 he began to attend the private art school of Sir James Thornhill, in Saint Martin's Lane, with a view to painting. In 1728-29 he painted a series of small conversation pieces, groups of family portraits connected by some common interest or occupation, besides others of a political and social character. Between 1727 and 1732 he engraved a large number of frontispieces for well-known books. In 1729 he ran away with his former master's daughter, Jane Thornhill, who made him an excellent wife.

Soon after his marriage he began the first of the series of paintings, "The Harlot's Progress," reproduced also as engravings, which made him famous. It represented in six plates the story of a country girl who came innocent to town to seek a situation. The original paintings, except one, are lost, but the plates are well known. The shameless piracy of these plates resulted in the Parliamentary act of 1735 vesting in artists the exclusive rights to their designs. In the same year appeared "A Rake's Progress," eight plates, representing the career of a profligate young man of means, who ends in the madhouse, the original paintings for which are in the Soane Museum, London. The third and most famous series, the "Marriage à la Mode," was not completed till 1745. It represents in six plates the story of a fashionable marriage between the son of an impoverished lord and the daughter of a wealthy city alderman. The original paintings are in the National Gallery, and are Hogarth's greatest work. Another prominent series was "Industry and Idleness" (12 sheets, 1747), executed as engravings only. They represent the respective careers of an idle and an industrious apprentice, and were intended for the working class. Besides these he executed briefer series, and many single plates.

Hogarth's art was essentially of a literary character, and he has well been called the Molière of painting. His constant endeavor was to point out the vices and follies of society, with the strict moral purpose of reforming. His great importance in the development of art lies in the fact that he was the first to turn his back on traditional practices, and to go directly to nature for the figures he painted. He is free from all foreign and ancient influence. In his portraits he is a technician of high order. His pictures are strongly and broadly painted, and are equally excellent in drawing and in color. His paintings excel his engravings, which are hastily executed and lack finish, although they are always spirited and intelligible.

He succeeded especially well in his portraits, the best of which is one of himself with his dog Trump (1745), in the National Gallery. This collection also contains portraits of his sister, Mary Hogarth (1746), Polly Peachum, David Garrick as Richard III., the Earl of Feversham, and the inimitable "Shrimp Girl." Among his other paintings of a didactic character, painted for engraving, were: "Southwark Fair" (1733); "Midnight Modern Conversation" (1734); the "Distressed Poet" (1735); the "Enraged Musician" (1741); "March to Finchley," and the "Election;" the two latter in the Soane Museum. He also attempted a few historical pictures on a large scale, but not with equal success.

Hogarth took a prominent part in the art controversies of his day, being the uncompromising foe of the imitation of the old masters—the 'black masters' as he called them, because of their darkened colors. In 1753 he published his *Analysis of Beauty*, setting forth his views on art; it was not a success, and brought ridicule upon him. After the death of his father-in-law in 1734, Hogarth converted his art school into a sort of life class, in which thirty or forty artists drew after the nude. In 1757 he was appointed sergeant-painter of all His Majesty's works, succeeding his brother-in-law, John Thornhill. His last days were marred by the ill success of his "Sigismunda Weeping Over the Heart of Her Husband," the harsh criticism of which was especially painful to Hogarth, as Sigismunda bore the features of his wife. An ill-advised effort in behalf of Lord Bute's Ministry in 1762 brought down upon him the terrible satire of Wilkes and Churchill, until then his intimate friends. Though much grieved, Hogarth retaliated by two prints: a hideous portrait of Wilkes, with a satyr's leer and squint, and "The Bruiser, C. Churchill." He died at London, October 25, 1764.

BIBLIOGRAPHY. Among the commentaries to Hogarth's works are: Trusler, *Hogarth Moralized* (London, 1768); Walpole, *Anecdotes of Painting*, vol. iv. (ib., 1771); Nichols and Steevens, *Genuine Works of Hogarth* (ib., 1808-17); Ireland, *Hogarth Illustrated* (ib., 1791-98), and *Graphic Illustrations of Hogarth* (ib., 1794-99); Lichtenberg, *Ausführliche Erklärung der Hogarthschen Kupferstiche* (Göttingen, 1794); Clerk, *Works of Hogarth* (London, 1806). Among the numerous editions of his *Works* are those of Nichols (London, 1820-22); of Monkhouse and Dobson (ib., 1872); and of Ireland and Nichols (ib., 1883). For his life, compare the biographies by Nichols (London, 1785), Sala (ib., 1866), and Dobson (ib., 1879).

HOGARTH CLUB. An artists' club in London, with headquarters at 36 Dover Street.

HOG CHOLERA. A virulent contagious disease of hogs, due to the presence of a pathogenic bacillus in the alimentary tract. The term has been used to cover at least two diseases, true hog cholera and swine plague (q.v.). Some authors have attempted to distinguish four or five diseases of the hog-cholera group, but the present tendency is to recognize only two.

The chief symptoms of hog cholera are a rise in body temperature, loss of appetite, a discharge from the eyes, watery at first but later yellowish and viscid, a purplish coloration of the skin, giving rise to a common name, blue sickness, occurring especially on the ears, chest, and abdomen, the under side of the neck, and on the inside of the thighs. Constipation is an early symptom, but diarrhœa soon sets in and persists until the death of the animal. The excrement is dark-colored, and possesses a fetid odor. The body temperature may rise from one to three degrees above the normal, but the elevation of temperature is frequently absent. The animals are dull and indifferent to surroundings, lie down a great part of the time and hide their heads under straw or litter, often have a dry cough, and sometimes squeal from intestinal pain. As the disease progresses they become gaunt with arching backs. The mortality from hog cholera under ordinary conditions is from 80 to 90 per cent. Acute cases may last from two to five days; chronic ones, a month. The characteristic pathological changes are enlargement of the spleen and a hemorrhagic condition of the large intestines and lymphatic glands. In chronic cases, ulcers are formed in the large intestines or the whole wall may become effused with blood.

Hog cholera and swine plague have been frequently confounded, but in typical cases they may be distinguished by clinical symptoms and post-mortem lesions. In most outbreaks of contagious hog diseases, hog cholera and swine plague occur in combination in the same animal. In general, however, the seat of infection in hog cholera is in the intestines; that of swine plague is in the lungs and secondarily in the intestines. A reddening of the skin is an indication of hog cholera, while coughing is more pronounced in cases of swine plague. For a reliable differential diagnosis of the two diseases it is necessary to make pure cultures of the micro-organisms which are concerned.

No satisfactory medicinal treatment has been devised for hog cholera. Recognized tonics which assist in keeping hogs in good physical condition may render them less susceptible to disease. A mixture containing sodium salts, sulphur, sulphide of antimony, and charcoal has proved as effective as any remedy. Serum therapy for hog cholera is still in the experimental stage, but has given promising results. The serum treatments devised by Pasteur and Lorenz have proved satisfactory in Europe. Experiments in the United States have demonstrated that serum used alone confers only a partial and temporary immunity to hog cholera. On the other hand, when antitoxic serum was used in combination with a virulent culture of the hog-cholera bacillus in the proportion of ten to one, a complete and lasting immunity was produced in more than 50 per cent. of cases.

It has been found practically impossible to disinfect hog pens and yards after an outbreak of hog cholera. Infected pens should be burned, and the surrounding ground should be cultivated to some crop for at least a year before again using as a hog-yard. Pens should be kept as clean as possible, and treated from time to time with lime or whitewash. By observing these precautions, preventing infection of the water-supply, and quarantining imported hogs before allowing them to run with the herd, the liability to infection from hog cholera will be much reduced. Consult: Nocard and Leclainche, *Les maladies microbiennes des animaux* (Paris, 1898); de Schweinitz, "Hog Cholera," and "Swine Plague," in *United States Department of Agriculture, Bureau of Animal Industry Reports* (Washington, 1889-92).

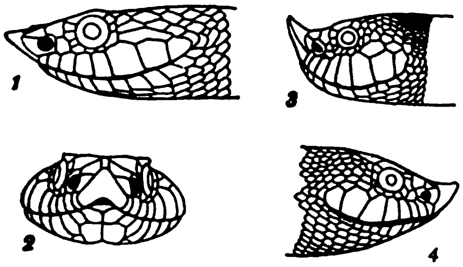
HOG-DEER. The 'para' or smallest of the East Indian rusine deer (*Cervus porcinus*), which takes its name from its habit of darting through the tall grass like a startled boar. It stands only two feet high at the withers. Its legs are comparatively short, and its antlers, having given off a brow tine, are nearly straight to the small terminal fork, and are mounted upon remarkably high pedicels. The general color is rufous brown, paler in summer and somewhat spotted. This deer ranges through Northern India, and down the coasts of Assam and Burma. It is very numerous, not gregarious, and forms a favorite object of jungle sport, sometimes by spearing.

HOGE, hōg, Moses Drury (1819-99). An American Presbyterian minister. He was born in Hampden-Sidney, Va., was educated there, and was made assistant in a Richmond church in 1844. When a second Presbyterian church grew out of the first, Dr. Hoge became its pastor (1845-85), and during the Civil War he succeeded in sailing to England from the blockaded port of Charleston to secure from the British and Foreign Bible Society a very large number of volumes for the use of Confederate soldiers. He was joint editor of the *Central Presbyterian* (1862-67).

HOGFISH, or Hogmolly. A local name for the log-perch (q.v.).

HOGG, James (1770-1835). A Scottish poet, known as the 'Ettrick Shepherd,' born in the parish of Ettrick, Selkirkshire, in 1770. His father was a poor farmer. The boy's education was slight, for he was taken from school to herd ewes. But from his mother he learned many folk-tales of giants, fairies, and brownies. Beginning to make songs for lasses to sing in chorus, he next wrote them out with great labor. His first poem was published anonymously in 1800. Going to Edinburgh, in 1801, to sell his employer's sheep, he wrote out from memory a little collection of his songs and published them roughly as *Scottish Pastorals, Poems, Songs, etc.* The next year he made the acquaintance of Scott, who was visiting the Ettrick forest in search of material for the *Minstrelsy of the Scottish Border.* Several ballads which Hogg and his mother furnished Scott appeared in the third volume of the *Minstrelsy* (1803). In 1807 Hogg published *The Mountain Bard*, original ballads suggested by Scott. With the proceeds of this volume and a treatise on sheep, amounting to £300, Hogg took a farm, which proved a disastrous venture. In 1810 he went to Edinburgh and began as professional author. Three years later appeared his most imaginative poem, *The Queen's Wake.* By this time he was becoming acquainted, directly or through correspondence, with some of the most eminent men of letters, who admired him greatly. He married in 1820, and retired to the farm of Eltrive Lake, in the valley of the Yarrow. He died November 21, 1835, and was buried in the Ettrick churchyard. In 1860 a monument was erected to his memory, overlooking Saint Mary's Lake. Hogg was immortalized as the Ettrick Shepherd by Wilson in the *Noctes Ambrosianæ.* Among his poems not cited above are *Madoc of the Moor, The Pilgrims of the Sun, The Jacobite Relics of Scotland, Queen Hynde*, and *The Border Garland.* These and other poems place Hogg, after Burns, among the greatest of the peasant poets of Scotland. Well known are such songs as "When the Kye comes Hame" and "Flora Macdonald's Farewell." Hogg also wrote many tales of uneven quality. The most remarkable is entitled *Confessions of a Fanatic.* Interesting, too, is the volume called *Winter Evening Tales*, depicting the manners of the border. Consult: *Works*, edited with memoirs by T. Thomson (London, 1865); "Poems," selected, in *Canterbury Poets* (London, 1886); and *Memorials of J. Hogg*, by his daughter, Mrs. Garden (London, 1885).

HOGNOSE. A harmless American serpent, remarkable for its blunt snout and curious manners. Three species form the colubrine genus Heterodon, all confined to North America, exclusive of the Pacific Coast and Mexico. The best known species (*Heterodon platyrhinus*) is one of our most common and widespread snakes. It is usually about two, but may be three, feet long, and is normally reddish-brown above, heavily blotched or obscurely barred with a darker tint; and underneath is greenish-white. Great variety in color and markings exist, however, and many seem sooty black or dark slate all over. It is always to be recognized by its pig-like snout and its extraordinary behavior when disturbed. It is timid and will hide or escape when possible; but if surprised or cornered it will throw itself into vigorous contortions, and perhaps soon tumble over on its back as if dead; or, more probably, it will inflate its long lung until its body swells up like a sausage, and at the same time extend its anterior ribs until its neck is surprisingly broad and flat, and then, opening wide its great mouth, will blow and hiss loudly. This alarming menace is meant to terrify its foes, and has led to the popular names of 'blowing viper,' 'spreading adder,' etc., and to the general belief that it must be very poisonous. Its blotched back, easily mistaken by the unobserving for that of a copperhead, adds to its evil reputation. Nevertheless, this snake is entirely harmless, and when handled is found to be so gentle that it can hardly be forced to bite.



HEADS OF HOGNOSE SNAKES.

1. Heterodon platyrhinus. 2. Face of same. 3. Heterodon nasicus. 4. Heterodon simus.

It feeds on mice, frogs, insects, birds' eggs, and so on, all obtained on the ground, for it is unable to climb trees. It lays a number of eggs, about an inch in length, in loose soil, into which it burrows for this purpose. The eggs are covered with a tough parchment-like coat, and probably hatch in a few days. There seems to be no precise time of laying; young have been reported from May until September. The young just issued from the egg will go through their contortions and hissing when molested, as do the adults. Much interesting information as to their breeding and other habits, collected by Abbott, Hay, and others, will be found summarized in Cope, *Crocodilians, Lizards, and Snakes*, published by the Smithsonian Institution (Washington, 1900).

The Southern States have a second species (*Heterodon simus*), and Texas and the Mexican border a third (*Heterodon nasicus*), in which the point of the snout is longer and more upturned than in the Northern forms.

HOG-PLUM, Spanish Plum, and Brazilian Plum. Names given in the West Indies and other tropical countries to the fruit of certain species of Spondias, a genus which belongs to the natural order Anacardiaceæ. The species are trees and shrubs with pinnate leaves, with terminal leaflets, and flowers in racemes or panicles. Some of them produce very pleasant fruits, among which may be mentioned *Spondias purpurea* and *Spondias lutea*, which are generally called hog-plum in the West Indies, because the fruits are a common food of hogs. *Spondias purpurea* has fruit about an inch in length, ovate or oblong, purple or variegated with yellow; yellow pulp with a peculiar but agreeable acid and aromatic taste. The fruit of *Spondias tuberosa*, called imbuzeiro in the north of Brazil, is about twice the size of a large gooseberry, oblong, yellowish, with a leathery skin and sweetish-acid pulp. A much-esteemed Brazilian dish is prepared of milk, curds, sugar, and the pulp of this fruit, from which also a refreshing beverage is made for use in fevers. The tree is remarkable for the numerous round black tubes, about 18 inches in diameter, which it produces on its widely spreading roots, and which are very cellular, and full of water. They are evidently intended for the wants of the tree in the dry season, and are often dug out by travelers for the sake of the water, of which each full-grown tuber yields about a pint. An important species is the ti or Tahiti apple (*Spondias dulcis*), a very fine fruit of the South Sea Islands. This tree often attains a height of 50 to 60 feet, and, according to Seeman, is laden with fruits averaging a pound each.

HOG-RAT. See Hutia.

HOGSHEAD. An old English measure of capacity. For wine, it was equivalent to 63 gallons or 52½ imperial gallons; for ale, 48 gallons, and for beer, 54 gallons. In the United States it is still used as a measure for liquids, equivalent to 63 gallons; but when used for tobacco, it varies in different States from about 750 to 1200 pounds.

HOGUE, ōg, or **HOUGUE**, o͞og, La. A roadstead near the northeast extremity of the Peninsula of Cotentin, Normandy, a few miles south of Barfleur. It gives its name to the naval battle of May 29 (old style May 19), 1692, when the combined English and Dutch fleets, under Admiral Russell, defeated the French fleet commanded by Tourville. The name of La Hogue is often confounded with La Hague, the name of the cape at the northwest extremity of Cotentin.

HOGUET, ō'gā', Karl (1821-70). A German painter, born in Berlin. He studied first under Krause, and then went to Paris, where he was a pupil of Ciceri, and afterwards of Isabey. His works are marine and genre, and belong to the French school. Among them are: "Rue Pirouette in Paris," "From Normandy," "Last Windmill on Montmartre," "The Wreck" (1864, Berlin Museum), "Market Scene at Rouen," and "Lighthouse Near Boulogne."

HOHENHEIM, hō'en-hīm, Philippus, A. P. von. See Paracelsus.

HOHENLINDEN, hō'en-lĭn'den (Ger., Tall Lindens). A village in Upper Bavaria, 19 miles east of Munich, celebrated for the victory gained there by the French, under Moreau, over the Austrians under Archduke John, December 3, 1800. Moreau's army was posted on the plateau between the Isar and the Inn, and barred the way to Munich, which was the Archduke's objective point. In three columns the Austrians advanced to the attack through forest and ravines in a blinding snow-storm. Moreau contented himself with holding them in check until Richepanse, whom he had sent around the enemy's flank, reached the Austrian rear. Then he hurled Ney against their front. Richepanse delivered his attack from the rear, and the Austrian army was destroyed between the two French forces. The Austrians lost 20,000 men and 100 guns, while Moreau's loss amounted to only 5000. The battle hastened the conclusion of peace at Lunéville, February 9, 1801.

HOHENLOHE, hō'en-lō'e. Formerly an earldom, later a principality, in Franconia, Germany. It was mediatized in 1806, the main portion being assigned to Württemberg and a part to Bavaria.

HOHENLOHE. A princely family of Germany, claiming descent from Eberhard, one of the early dukes of Franconia. The family first appears in history in the early part of the twelfth century in possession of the Castle of Holloch, near Uffenheim. The first count we hear of is Heinrich, who lived in the twelfth century. He left two sons, Konrad and Gottfried, who followed the fortunes of the Hohenstaufen, and founded, respectively, the lines of Hohenlohe-Brauneck and Hohenlohe-Holloch. The former became subdivided into the Haltenbergstetten and Brauneck branches, both of which were extinct in 1390; the latter into the Weikersheim and Uffenheim, or Speckfeld, branches, of which the latter became extinct in 1412. In 1551 a new division in the Weikersheim line gave rise to the branches of Hohenlohe-Neuenstein and Hohenlohe-Waldenburg, which still continue. In the Reformation the Neuenstein branch became Protestant, while the Waldenburg counts remained Catholic. Princely rank was conferred upon the latter branch in 1744, and on the former in 1764. Of the Neuenstein branch there were two lines: Oehringen, extinct in 1805, and Langenburg, the latter being further subdivided into the Hohenlohe-Ingelfingen (Oehringen after 1805), and Hohenlohe-Kirchberg, extinct in 1861. The Waldenburg branch formed two lines: Bartenstein, with the cadet branch of Jagstberg, and Schillingsfürst, to which was added the Duchy of Ratibor. Among the prominent members of the Hohenlohe family are:

FRIEDRICH LUDWIG, PRINCE OF HOHENLOHE-INGELFINGEN (1746-1818). He distinguished himself at the storming of Weissenburg (1793), and won the battle of Kaiserslautern (September 20, 1794). After the defeat of Jena, in which he shared, he succeeded the Duke of Brunswick in command and capitulated at Prenzlau with 17,000 men (October 28, 1806). For this he was severely censured and forced to retire from further participation in the campaign.—KRAFT KARL AUGUST EDUARD FRIEDRICH, PRINCE OF HOHENLOHE-INGELFINGEN (1827-92). A Prussian general of artillery. He received a thorough training for the artillery service, and was placed in several positions of responsibility. In 1866 he held an important command at Sadowa, and in 1870 he commanded the artillery of the Guards in all its engagements, including Saint-Privat and Sedan. He was chief of artillery at the siege of Paris. He was made a lieutenant-general in 1873, adjutant-general in 1875, general of infantry in 1883, and general of artillery in 1889. He died in Dresden, January 16, 1892. He was the author of several works on military science: *Militärische Briefe* (1887-90); *Strategische Briefe* (1887); *Die Feldartillerie in ihrer Unterstellung unter die Generalkommandos* (1889); *Ideen über Befestigungen* (1888); also, *Gespräche über Reiterei* (1887).—CHLODWIG KARL VICTOR, PRINCE OF HOHENLOHE-SCHILLINGSFÜRST, Duke of RATIBOR and KORVEI (1819-1901). Chancellor of the German Empire from 1894 to 1900. He was born March 31, 1819, at Rotenburg-an-der-Fulda. His mother was a princess of Hohenlohe-Langenburg. He studied political science and jurisprudence at Heidelberg, Göttingen, and Bonn. Before he came to his title of Duke of Ratibor and of Korvei, in 1845, he held offices in connection with the law courts at Ehrenbreitstein and Potsdam. In the Bavarian Diet he opposed the Ultramontane policy, and in 1866 he strove to bring over Bavaria to the side of Prussia. At the close of the year he became Bavarian Minister of Foreign Affairs and president of the Ministerial Council, holding office till March, 1870. His efforts in behalf of a united Germany long met with fierce opposition, but he saw clearly the triumph of the cause for which he had worked, and entered the First German Reichstag as a member of the *Reichspartei*. In 1874 he was appointed German Ambassador to Paris, and in 1878 he was the third German Plenipotentiary at the Congress of Berlin. In 1885 he became Governor of Alsace-Lorraine, in which position he displayed conspicuous tact. On the resignation of Count Caprivi, in 1894, Prince Hohenlohe was created Imperial Chancellor. This office he resigned in 1900, being succeeded by Count von Bülow. During his long career in German politics Prince Hohenlohe did much to promote German unity. He had to face the hostility of the anti-Unionists in Bavaria, and was one of Bismarck's chief supporters in that statesman's Imperial policy. As Governor of Alsace-Lorraine, Hohenlohe aided greatly in teutonizing the provinces. As Chancellor he promoted the colonial policy, and favored the creation of a powerful navy. He was a favorite with William II., whose masterful policy he did not oppose, and with whom he was on the best of terms up to the time of his resignation, in October, 1900. It was said that the cause of his resigning the Chancellorship was dissatisfaction with the advanced or 'forward' policy favored by the Emperor, especially in so far as it related to China. He died at Ragatz, Switzerland, July 6, 1901.—GUSTAV ADOLF (1823-96), PRINCE OF HOHENLOHE-SCHILLINGSFÜRST. A brother of the Chancellor. He took holy orders in 1849, and became in 1857 Bishop of Edessa *in partibus*, and almoner to Pius IX. He was made a cardinal in 1866. He was opposed to Jesuit influence in Rome, and endeavored to prevent the Kulturkampf (q.v.). He was sent to Rome in 1872 as Ambassador to the Holy See, but his appointment was rejected by Pius IX. He returned to Rome in 1876, and subsequently gained the favor of Leo XIII. From 1879 to 1884 he was Bishop of Albano, and became subsequently Archpriest of Santa Maria Maggiore in Rome. He died in Rome, October 30, 1896.—HERMANN, PRINCE OF HOHENLOHE-LANGENBURG (1832—). He entered the Württemberg army, was in the Austrian service from

1854 to 1860, and was a general in the army of Baden from 1862 to 1871. He has been a member of the Upper Chamber of Württemberg since 1860, and was elected its vice-president in 1893. He was a member of the Imperial Reichstag from 1871 to 1880, and acted with the *Reichspartei*. (See POLITICAL PARTIES, paragraph on *Germany*.) In 1894 he became Governor of Alsace-Lorraine. He was the founder and president (1883-94) of the Deutsche Kolonialgesellschaft. He holds the military rank of general of cavalry in the Prussian Army.

HOHENSTAUFEN, hō'en-stou'fen. A princely house of Swabia, in Germany, which held possession of the German Imperial throne from 1138 to 1254. The family traced its descent from Frederick of Büren, who lived about the middle of the eleventh century, and whose son, Frederick of Staufen, built the castle from which the family derived its name, some vestiges of which are still to be seen on the summit of the Hohenstaufen, one of the peaks of the Rauhe Alb, close to the town of Göppingen, Württemberg. The son, Frederick of Staufen, was a faithful partisan of the Emperor Henry IV., and in return received Henry's daughter and the Duchy of Swabia in 1079. Duke Frederick, at his death in 1105, left two sons—Frederick II., the One-Eyed, and Conrad; the former was immediately confirmed in the possession of Swabia by Henry V., and in 1112 the latter received the Duchy of Franconia. Upon the death of Henry V. in 1125 his family estates fell to the House of Hohenstaufen. It seemed, too, as if the Imperial dignity would be conferred upon Frederick on account of his talents and popularity; but Lothair of Saxony, his rival and enemy, was elected as Henry V.'s successor. On Lothair's accession, he demanded the Imperial possessions held by the House of Hohenstaufen, and a war ensued between him and the Hohenstaufen princes, in which Lothair was supported by the House of Welf (Guelph). In the course of this struggle Conrad was crowned King of Italy in 1128; but the two brothers were forced to make peace with Lothair in 1135, and afterwards lent him their support. After Lothair's death, Conrad was elected King of Germany, in 1138, as Conrad III. (q.v.). Under Conrad III. the House of Hohenstaufen waged war against the House of Guelph, which for a brief time was weakened by the loss of Bavaria.

On Conrad's death, in 1152, his nephew, Frederick I. Barbarossa, became Emperor. As he was the offspring of a Hohenstaufen father and a Guelph mother, it was hoped that the struggle between the two houses might be ended by his accession. But the defiant attitude of Henry the Lion, Duke of Saxony and Bavaria, the powerful representative of the Guelph family, caused the conflict to break out afresh in 1180. Henry the Lion was conquered and deprived of most of his possessions. Frederick went on the Third Crusade, but died in 1190, before reaching Jerusalem. His son, Henry VI., succeeded to the throne without opposition. By a marriage with the heiress of Sicily and by conquest he added Southern Italy and Sicily to the Empire. He exercised the most far-reaching power of any of the Hohenstaufen, and dreamed of a world-wide empire. Richard the Lion-Hearted of England was obliged to become his vassal in order to be freed from captivity. Some of the Christian rulers in the East had sought protection from Henry, and he sent an army to the Holy Land, 'the German Crusade' (see CRUSADES) to establish his own supremacy. His plans were frustrated by his early death, in 1197. His son Frederick II. had already been crowned King of Germany, but as he was only a child of three, his rights were passed over. The Guelphs chose Otho of Brunswick, son of Henry the Lion, and the choice of the partisans of the Hohenstaufen fell upon Philip of Swabia, uncle of Frederick II. Civil war followed, the contest terminating with the assassination of Philip in 1208 by Otho of Wittelsbach. For a time Otho of Brunswick (Otho IV.) was recognized as ruler; then his opponents rallied about Frederick II., who in the meanwhile had been ruling his Kingdom of Sicily, which he had inherited from his mother. Frederick was crowned, and by 1215 was recognized by all except a few obstinate partisans of Otho IV. He ruled over Germany, Italy, and Sicily, and also became King of Jerusalem. His reign was spent to a great extent in a struggle with the Papacy. The partisans of the Hohenstaufen in Italy and the opponents of the Imperial power, in general the supporters of the Papacy, were known respectively as Ghibellines and Guelphs. (See GUELPHS AND GHIBELLINES.) After Frederick's death, in 1250, the inveterate animosity of the Guelphs followed his son, Conrad IV., who abandoned Germany for his hereditary Italian possessions, and died in 1254. After Conrad's death his half-brother Manfred fought for the Hohenstaufen interests until he was defeated and killed at the battle of Benevento, in 1266, against Charles of Anjou, who at the invitation of the Pope, had undertaken the conquest of the Two Sicilies. Manfred's sons were kept in prison until his death. His daughter married Peter III. of Aragon, who later avenged the destruction of the Hohenstaufen by expelling their foes from the Kingdom of Sicily. Conrad's young son, Conradin, in an attempt to reconquer the Two Sicilies, was taken captive by Charles of Anjou at the battle of Tagliacozzo, and executed at Naples on October 29, 1268. Enzio, an illegitimate son of Frederick II., who had been made King of Sardinia, died in prison four years later. Thus all of the male descendants of Frederick II. perished. The emperors of this family rank among the ablest rulers of Germany, and hold the first place in popular German tradition today, just as they held the first place in the affections of the people during their lifetime. They appear in general as men possessed of great virtues and of great faults, and impressive by reason of both. Frederick Barbarossa, according to the legend, is not dead, but asleep, and will wake to help his people in time of need. Frederick II. is one of the most remarkable figures of the Middle Ages in his character as ruler, knight, scholar, and free-thinker. Consult Raumer, *Geschichte der Hohenstaufen* (5th ed., Leipzig, 1878). See, also, articles on the individual emperors.

HOHENSTEIN, hō'en-stīn. A manufacturing town in the Kingdom of Saxony, 12 miles northeast of Zwickau (Map: Prussia, E 3). It produces chiefly textiles and knit goods; in the neighborhood are mines of sulphur, arsenic, and gold. Population, in 1890, 7546; in 1900 (with the neighboring town of Ernstthal annexed in 1898), 13,397.

HOHENWART, hō'en-värt, KARL, Count (1824-99). An Austrian statesman, leader of the Federalist party. In 1868 he became Governor of Upper Austria, and three years afterwards succeeded Potocki as president of the Ministry. In his Cabinet he held the portfolio of the Interior. His federalist policy met with such opposition on the part of the Hungarian Ministry and the German Liberals that he was forced to resign after holding office for less than a year. He was elected to the Lower House in 1873, and became a leader of the Right Centre. In 1885 Hohenwart was appointed president of the Supreme Court of Accounts, and in 1891 he formed the Hohenwart Club, consisting of German Conservatives, Slovenes, Croatians, and Rumans, as well as the great landed proprietors of Bohemia. But this party broke in 1895, through the defection of the German members, and in 1897, on the appointment of its leader to the House of Lords, it disintegrated entirely.

HOHENZOLLERN, hō'en-tsŏl'lērn. A province of Prussia, consisting of a narrow strip of land entirely surrounded by Württemberg and Baden, and covering, together with its nine exclaves, an area of about 440 square miles (Map: Prussia, C 4). It extends from the Neckar in the northwest to the vicinity of Lake Constance. It is divided by the Rauhe Alb, which rises in places to 3000 feet. The Danube crosses the province, which is well watered. The mountain valleys are productive, and yield grain, fruit, hops, etc. The Alb chain yields some iron, and in other mountains some deposits of rock salt are found. Mineral springs abound. Some manufacturing is done in the way of cotton-spinning, the production of iron of superior quality, etc. Administratively the province is divided into the four districts of Sigmaringen, Gammertingen, Haigerloch, and Hechingen. Since 1873 it has had a Landtag sitting at Sigmaringen. It sends one Deputy to the Reichstag. The population numbered, in 1900, 66,783. The inhabitants are nearly all Roman Catholics, and the province forms a dependency of the Archbishop of Freiburg. On a steep eminence near Hechingen stands the magnificent Castle of Hohenzollern, erected in the second half of the nineteenth century, in the style of the fourteenth century, on the ruins of the mediæval stronghold, the cradle of the reigning Hohenzollern dynasty of Prussia.

HOHENZOLLERN. The family name of the royal house of Prussia, in which has been vested also, since January 18, 1871, the dignity of German Emperor. The name is derived from the ancestral Castle Zollern, or Hohenzollern, in Swabia (see preceding article). The origin of the house is involved in obscurity, and the story of its descent from Count Thassilo, a Swabian noble of the time of Charles the Great, is a fiction of the sixteenth century. The family name occurs as early as the eleventh century in the persons of Burchard and Wezel of Zolre, who were killed in 1061, but whether there is any relationship between these and the succeeding Hohenzollern family is a matter of doubt. The House of Hohenzollern occupied a prominent position among the petty princely families of Swabia as early as the first half of the twelfth century, and at the close of that century we find Count Frederick of Zolre invested with the Burggraviate of Nuremberg, an Imperial office, which descended to his posterity. His sons, Frederick and Conrad, divided the possessions of the house in 1227, founding the Swabian and Franconian lines. From the close of the sixteenth century the elder or Swabian branch of the House of Hohenzollern existed in the two lines of Hohenzollern-Hechingen and Hohenzollern-Sigmaringen. In 1695 a pact of inheritance was made between these branches and that of Brandenburg (see below). In 1821 a new covenant was drawn up and confirmed by the King of Prussia, as head of the Hohenzollern family, by which it was provided that in case of failure of male issue in either line possession should pass to the other, and on the extinction of both lines should vest in the royal family of Prussia. But before the prospect of extinction presented itself the princes of Hohenzollern-Hechingen and Hohenzollern-Sigmaringen, after the commotions of the revolutionary year 1848, decided to abdicate in favor of the King of Prussia. The act of renunciation took place at the close of 1849, and in accordance with the covenant of 1821 the King of Prussia took possession of the two principalities in the following year, the two princes being given annual pensions. Leopold of Hohenzollern, the prince who was offered the crown of Spain in 1870, was the eldest son of the last ruler of Hohenzollern-Sigmaringen. The second son, Charles, became Prince and King of Rumania.

The great destiny of the family was reserved for the cadet branch, the Franconian line. They attached themselves to the Hohenstaufen until that great house became extinct, when they gave their support to Rudolph of Hapsburg. During the civil war which followed the double election of 1314 they sided with Louis of Bavaria against the House of Austria, but subsequently they became once more faithful supporters of the Hapsburgs. Acquisitiveness and a capacity to hold what was once obtained and to administer it with thrift seem to have characterized to a greater or less degree all the Franconian Hohenzollern princes. From the founder of the line, Conrad III. (died 1261), there was a steady gain in territory and influence under Frederick III. (1261-97), Frederick IV. (1297-1332), John II. (1332-57), and Frederick V. (1357-98). The possessions of the house, in which was vested the Burggraviate of Nuremberg, were constituted into the two margraviates of Bayreuth (originally Culmbach) and Anspach. The sons of Frederick V., John III. and Frederick VI., possessed respectively Bayreuth and Anspach, the latter inheriting his brother's possessions in 1420. Frederick VI. in 1411 received the Margraviate of Brandenburg as a pledge for a loan to the Emperor Sigismund, and in 1415 it was granted to him as an hereditary possession, together with the dignity of Elector. This was the foundation of the real greatness of the House of Hohenzollern.

The Elector Albert Achilles of Brandenburg by the so-called *Dispositio Achillea* of 1473 decreed that the Franconian margraviates (Anspach and Bayreuth) should be separated from Brandenburg and ruled as secundogenitures. The last Margrave of Bayreuth died in 1769, when the State was united with Anspach. In 1791 the Margrave of Anspach and Bayreuth sold his principalities to Prussia, which, however, retained them only a few years.

The electors of Brandenburg were as follows:

Frederick I. (the Frederick VI. mentioned above).	(1415-1440)
Frederick II	(1440-1470)
Albert Achilles	(1470-1486)
John Cicero	(1486-1499)
Joachim I. Nestor	(1499-1535)
Joachim II. Hector	(1535-1571)
John George	(1571-1598)
Joachim Frederick	(1598-1608)
John Sigismund	(1608-1619)
George William	(1619-1640)
Frederick William, the Great Elector	(1640-1688)
Frederick III	(1688-1713) after 1701, King Frederick I. of Prussia

The Hohenzollern kings of Prussia since Frederick I. have been as follows:

Frederick William I	(1713-1740)
Frederick II. the Great	(1740-1786)
Frederick William II	(1786-1797)
Frederick William III	(1797-1840)
Frederick William IV	(1840-1861)
William I	(1861-1888), after 1871, German Emperor
Frederick III	(1888)
William II	(1888—)

The history of the Hohenzollern family from the fifteenth century is that of BRANDENBURG, PRUSSIA, and GERMANY. Consult: Stillfried-Alcantara and Kugler, *Die Hohenzollern und das deutsche Vaterland* (Munich, 1881), a well-ordered account, dedicated to Emperor William I., and presumably having a semi-official standing; Waddington, *L'acquisition de la couronne royale de Prusse par les Hohenzollern* (Paris, 1888), a valuable study of Hohenzollern history in the seventeenth and eighteenth centuries, with many documents; Berner, *Die Abstammung und älteste Genealogie der Hohenzollern* (Berlin, 1893); Seidel, *Hohenzollern-Jahrbuch, Forschungen zur Geschichte der Hohenzollern in Brandenburg-Preussen* (Leipzig, 1897 et seq.); Tuttle, *History of Prussia* (Boston, 1884-96), one of the best products of American historical scholarship, cut short at 1757 by the death of the author.

HÖHNEL, hē̆′nel, LUDWIG VON (1857—). An Austrian explorer, born at Pressburg and educated at the Naval Academy of Fiume. In 1887 he accompanied Count Teleki in the journey from Zanzibar, on which lakes Rudolph and Stephanie were discovered, and a large area, before unknown, carefully plotted on Höhnel's maps. The expeditions proved the connection between the Abyssinian plateau and the Rand. Lieutenant Höhnel described the results of his journey in his book, *Zum Rudolfsee und Stefaniesee* (1892). In 1892-93 he explored with an American traveler, William Astor Chanler (q.v.), the country between the rivers Tana and Juba. Consult Chanler, *Through Jungle and Desert* (New York, 1896).

HÖHSCHEID, hē̆′shīt. A town of the Prussian Rhine Province, situated on the Wupper, 17 miles east-southeast of Düsseldorf (Map: Prussia, B 3). It has extensive manufactures of steel products and machinery. Population, in 1890, 12,593; in 1900, 14,172.

HOI-HOW, hoi′hou′. The seaport of Kiung-chow (q.v.).

HOJÉDA, ō̇-HÄ′DȦ ALONSO DE. See OJÉDA.

HŌJŌ, hō′jō̇. The name of five towns in Japan, from one of which, in Idzu (q.v.), arose the celebrated family of regents known as the Hōjō, which, during the era of the puppet Shoguns at Kamakura (A.D. 1219-1333), ruled the Empire. During their régime Buddhism developed rapidly, and the Mongol invaders under Kublai Khan were driven off and their armada destroyed. The Hōjō were overthrown by one Nitta Yoshisada in 1333. Consult: Griffis, *The Mikado's Empire* (New York, 1900); Adams, *History of Japan*, vol i. (London, 1884); Brinkley, *Japan, Its History, Arts, and Literature* (Boston, 1901-02).

HOKITIKA, hō′kė̄-tē′kȧ. The capital of Westland County, on the northwest coast of South Island, New Zealand (Map: New Zealand, C 5). It lies 24 miles southwest of Greymouth, with which and with Nelson it is connected by rail. It has thriving agricultural industries, while gold-mining, formerly of great importance, is still carried on. Population, in 1901, 1951.

HOKKAIDO, hŏ̇k′kī′dō̇. See YEZO.

HOK-KIEN, hŏ̇k′kė̄-ĕn′. See FU-KIEN.

HO-KOW, hō′kou′. The name of a number of towns in China, the most important of which are the following: (1) A town in the Province of Kiang-si, on the right bank of the Poyang-hu Lake, opposite Kiu-kiang (Map: China, E 6). It has an extensive trade in black tea. Estimated population, 300,000. (2) A treaty port in the northern part of the Province of Yun-nan, on the left bank of the Red River, nearly opposite Lao-kai in Tongking, with which it is connected by a suspension bridge, completed in 1900. It has about 4000 inhabitants and was opened for foreign trade in accordance with the supplementary convention between China and France of June 20, 1895. The trade is as yet insignificant. (3) A small town in the northern part of the Province of Shan-si, at the confluence of the Hei-shui and the Hoang-ho. It lies near the beginning of the highway to Peking and has important soda-works.

HOKUSAI, hōk′o͞o-sī (1760-1849). A noted Japanese artist. He was born at Honjō, in Yedo (now Tokio), son of an artisan named Nakashima Ise, a maker of metal mirrors in the employ of the Shogun of the time. Little is known of his life beyond what he himself tells in the prefaces to his numerous works. At thirteen he left home and apprenticed himself to an engraver. Five years afterwards he gave up engraving to study with Shunsho, the most noted designer of the time, but was expelled in 1786 for persistently indulging in a style that was displeasing to his master. He tried to make a living by illustrating comic books, but not meeting with success, he became a peddler, continuing to draw and paint as he had opportunity. In order to attract attention and raise money, he in 1804 exhibited his dexterity by painting in public a colored figure of a Buddhist saint on a sheet of paper 18 yards long and 11 yards wide, using brooms for brushes and buckets to hold his liquid India ink. Three years later he became associated with Bakin, the novelist, and collaborated with him in illustrating a work translated from the Chinese by Bakin, and containing 108 portraits of Chinese heroes. This appeared in 1828. His connection with Bakin lasted only four years, and he was again adrift. His public career really did not begin until 1810, when he became an industrial artist and a teacher of drawing. Pupils flocked to him in numbers so great that he could not supply them with original drawings of his own as models, so he began wood-engraving in order to furnish the needed number. In this way his *Mangwa*, or album of "Ten Thousand Sketches," took form, and his fame spread as volume after volume and edition after edition appeared. The later volumes of this series appeared in 1836, a year after his *Fugakŭ Hiyakŭkei*, or *Fuji Hiakke* ("A Hundred Views of Fujisan"). His industry was great, and his works numerous. Thirty thousand drawings of his have been counted up, yet he was always in poverty. He died April 13 (some say May 10), 1849, at Asakusa, a district of Yedo. Money for his funeral was provided by his pupils and admirers.

Hokusai was a man of the people to the end. He never rose above his class, and never made any attempt to do so. His talent lay in producing *Ukio-ye* ('pictures of this passing world'), free from the conventionalities of his predecessors and his contemporaries. His influence on modern art has been very great. His whole life was spent in perfecting himself; yet when he came to die his last words were, "If Heaven would only grant me ten more years!" and a moment later, "If Heaven had only granted me five years more, I could have been a thorough artist." His signatures were numerous. In 1798 he appears under the name of 'Sori;' in the following year he changed this to 'Sori, who has changed his name to Hokusai.' In 1800 he called himself simply 'Hokusai' ('North Studio'). A favorite signature was 'Hokusai Gwa-Kio Rōjin' ('Hokusai, the old man crazy about drawing'). His latest name was 'Manji' (the Swastika), and the inscription over his grave is the one he preferred—'Manji Gwa-Kio Rōjin.' A full list of his works (with a bibliography) is in Anderson's *Descriptive and Historical Catalogue of Chinese and Japanese Art* (London, 1886).

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HOL, RICHARD (1825-1904). A widely known Dutch pianist, organist, and composer, born at Amsterdam. A brilliant exponent of the modern romantic German school, he received many decorations and foreign orders for his services to the cause of music. In 1856 he was director of the Amstels Männerchor; 1857, director of the Society for the Promotion of Music; 1862, city musical director of Utrecht; 1869, cathedral organist; 1875, director of the School of Music. Hol was perhaps better known in America as a composer of part songs for male or female voices. His compositions include an oratorio, two operas, two symphonies masses, songs, chamber music, orchestral music, etc. His male choral works are standard with the leading men's choruses.

HOL'ABIRD, SAMUEL BECKLEY (1826—). An American soldier, born in Canaan, Conn. He graduated at West Point in 1849, served with the army of the Potomac (1861-62), and became brigadier and quartermaster general (1883), as well as translator for the army. His chief translation was General Jomini's *Treatise on the Grand Military Operations of Frederick the Great* (1865).

HOLARCTIC REGION (from Gk. ὅλος, *holos*, entire + ἀρκτικός, *arktikos*, northern, from ἄρκτος, *arktos*, bear). A division in zoögeography, defined in two senses: (1) *Arctogæa.*—In the larger sense the term is used, unhappily, as a synonym for 'Arctogæa.' (See DISTRIBUTION OF ANIMALS and NOTOGÆA.) This 'region' embraces all of the Northern Hemisphere except the hot coast regions of Central America, all of Africa and Madagascar, and an indefinite extent of the Malayan and Polynesian islands, where its boundaries vary in different classes of animals; in other words, it is a combination of the Nearctic, Palæarctic, Palæotropical, and Oriental regions of Sclater and Wallace, as opposed to the combined Neotropical and Australasian regions (Notogæa). The fundamental difference between Arctogæa and Notogæa reaches back to an early geological period, while many of the present distinctions between their subdivisions disappear when traced back to the Tertiary, when the distribution of animal life was very different from now. It is this broad historical view, rather than the modern aspect, which has led naturalists to the generalizations of Arctogæa and Notogæa. Limiting the comparison to vertebrate animals, the characteristics of Arctogæa are in outline as follows: Among fishes, the perches, carps, salmons, and sturgeons are present as whole tribes, together with many lesser groups, especially of fresh-water or coast fishes, while the lungfishes are conspicuous absentees. In the class Amphibia, the line is drawn at the frog family Cystignathidæ, which is entirely Arctogæan. Gadow also points out the predominance of Arcifera, which constitute nine-tenths of the anurous population, and are hardly represented in Notogæa. Of turtles, the presence of Trionychoidea and the absence of Chelydidæ are distinctive. Of lizards, exclusively Arctogæal groups are the Lacertidæ, Zomoridæ, Gerrhosauridæ, and Aniellidæ. Among the snakes, the viper family is entirely Arctogæal, and the crotaline tribe mainly so. Lesser exclusive groups are the Uropeltidæ, Xenopeltidæ, and many genera. Ornithological distinctions may be most easily sketched by saying that Arctogæa possesses no emus or cassowaries; no mound-birds, birds of paradise, lyre-birds, cockatoos, tinamous, curassows, hoactzins, toucans, cotingas, or many others, although it is rich in game birds, finches, woodpeckers, wood-warblers, and the like. But perhaps the most striking difference is the presence of the large Arctic tribe of auks, and the like, and the absence of penguins. Among mammals, also, the most notable feature is the entire absence of edentates, of monotremes, of marsupials (except one opossum), of cebine monkeys, and of marmosets. The northern region, however, has the lemurs, the insectivores except the West Indian Solenodon, the elephants, rhinoceroses, hyraces, horses, deer, giraffes, bovines, hyenas, hares, and a variety of other important families; it is, in fact, as Beddard points out, the headquarters of all the Eutheria except edentates and marsupials.

(2) *Holarctic, or Periarctic, Province.*—In a more restricted and perhaps more usual sense, the term 'holarctic' in zoögeography denotes a circumpolar district formed by the union of the Palæarctic and Nearctic provinces of Sclater and Wallace, elsewhere described. It was long ago felt that the faunal characteristics of North America and the northern part of the Old World were not sufficiently distinct to justify their separation into two provinces. Their union under one name was first made by A. Heilprin,

who proposed 'Triarctic' as the new designation. For this A. Newton suggested the substitution of 'Holarctic,' which Heilprin at once adopted. More recently Gadow has used 'Periarctic' as a synonym, on the ground that it is more precise. Its faunal characteristics are those sketched in the first paragraph, with the omission of such forms as are exclusively Ethiopian (Africa, south of the Sahara) or Oriental (the Asiatic coast and islands south of the Himalayan watershed). The faunal agreement between North America and the northern part of the Old World is greater than any differences. There are few families not represented in both, and the distinctive animals are mainly local genera or species, while a great many apparently identical forms occur on both continents, having a circumpolar distribution due either to their powers of travel or to ancient land connections. Consult: Heilprin, *Geographical and Geological Distribution of Animals* (New York, 1887); Newton, *Dictionary of Birds* (New York, 1896); and the authorities referred to under DISTRIBUTION OF ANIMALS. See also NEARCTIC REGION; PALEARCTIC REGION.

HOLBACH, ôl'bäg, PAUL HENRI THYRY D', Baron (1723-89). A French philosopher of the eighteenth century, and one of the Encyclopædists. (See ENCYCLOPÉDIE.) He was born of wealthy parents, at Heidelsheim, in the Palatinate, in 1723. At an early age he went to Paris, where he continued to reside during the remainder of his life. As Holbach was remarkable for his agreeable social qualities, and kept a good table, the most eminent thinkers and writers of the day, such as Condorcet, Diderot, Duclos, Helvétius, Raynal, Rousseau, Buffon, etc., were in the habit of assembling at his house. The witty Abbé Galiani called Holbach the *maître d'hôtel* of philosophy. Here speculation, it is said, was carried to such daring lengths that Buffon, D'Alembert, and Rousseau were compelled to withdraw from the circle. Holbach was the zealous champion of naturalism, and contended not only against Christianity, but against all positive religion. His principal work, the *Système de la nature* (published anonymously in 1770), has been called the "Bible of Naturalism." In this work the author endeavors to expound the principles of morality upon a sensualistic, materialistic, deterministic, egoistic, and atheistic basis. For him God is only an ideal being, created by kings and priests. The work is in no sense original, but gives voice to the materialism of the French *philosophes* of the eighteenth century, which is nowhere more openly advocated than in the writings of Holbach. He was a man of good heart, and, in spite of his theory, of most unselfish benevolence. When the Jesuits fell into disgrace during the reign of Louis XV., Holbach, though he hated their system and had written against them in the days of their prosperity, made his house an asylum for his old foes when the clouds gathered around them. Many anonymous works besides the *Système* have been attributed to Holbach. Consult: Avezac-Lavigne, *Diderot et la société du baron d'Holbach* (Paris, 1878); Morley, "Three Works of the Eighteenth Century, I. Holbach's System of Nature," in *Fortnightly Review* (London, 1877); id., *Diderot and the Encyclopædists* (London, 1878; 2d ed. 1886).

HOLBEIN, hôl'bīn, HANS, the Elder (c. 1460-1524). A noted German painter, whose reputation was for a long time overshadowed by that of his celebrated son, Hans the Younger, to whom most of the elder master's finest productions were formerly attributed. But little is known of his life. He was born at Augsburg, the son of the tanner Michael Holbein, and resided there at intervals for many years, alternately prosperous and in want, first mentioned in the rate-books of the city in 1494. He became a citizen of Ulm in 1499, and two years later visited Frankfort. After 1516 he lived at a short distance from Augsburg, and in 1517 wandered off to paint an altarpiece at Isenheim, in Alsace, where he died. The name of his master is not known; that he worked for some time in the studio of Martin Schongauer at Colmar is a mere surmise suggested by a certain resemblance of style, especially in the types of his heads. Undoubtedly Holbein formed his style on the models of the early Flemish school, and subsequently modified it by yielding to local tradition and Italian influences. In his early pictures slender figures, mild and regular features, staidness of attitude, and a clear transparency of tone unrelieved by depth of shadow, are the prevailing characteristics. To this class belong the "Virgin and Child, with Two Angels," in Sankt Moritz Chapel, Nuremberg, and a "Virgin and Child Enthroned, with Angels," in the Landauer Brüderhaus in that city. Of a similar stamp are four altar panels (1493), representing "Joachim's Sacrifice," "Birth and Presentation of Mary," and "Presentation of Christ," in the Cathedral of Augsburg. Somewhat less marked is the Flemish origin of the master's manner in a series of "Scenes from the Passion" (1499), and the altarpiece (1499) with the "Basilica of Santa Maria Maggiore" in the centre, "Coronation of the Virgin" above it, the "Nativity" and "Martyrdom of Saint Dorothea" in the wings, both in the gallery at Augsburg. To the year 1499 belongs also the "Death of the Virgin" in the Basel Museum. In Frankfort he painted for the Dominicans a composite altarpiece (1501), comprising the "Last Supper," "Entry of Christ Into Jerusalem," "Expulsion of the Jews from the Temple," etc., and "Seven Scenes from the Passion," now all in the Städel Institute at Frankfort. Of the same period are the "Crucifixion," "Descent from the Cross," and "Entombment," also "Sixteen Scenes from the Life of Mary," all parts of a large altarpiece (1502) in the Old Pinakothek at Munich; a "Transfiguration" (1502) and "Christ Crowned with Thorns," both in the Augsburg Gallery. A marked progress in the master's manner is to be noticed in the "Life of Saint Paul" (1504), in its more ideal conception, correct drawing, and delicate execution, and of traditional interest as containing the portraits of the artist and his two sons, Ambrosius and Hans. The influence of the Italian Renaissance is still more apparent in the greater expressiveness and beauty of coloring displayed in the "Saint Catharine Altar" (1512), this and the preceding also in the Augsburg Gallery; but his maturest work is the "Martyrdom of Saint Sebastian" (1515-16), in the Pinakothek at Munich, a composition full of dramatic power, far transcending any of his previous efforts. His last important work was probably the "Fountain of Life" (1519), in the royal palace at Lisbon.

Holbein the Elder also excelled as a portrait painter, and his rare gift for characterization is apparent especially in the numerous head studies, mostly in silver point, distributed in various collections, among which those in Berlin, Copenhagen, and Basel are the richest. The museum at Basel also possesses a number of sketches for his religious paintings.

His brother Sigismund (?-1540) first appears on the rate-books of Augsburg in 1504, and in 1519 removed to Bern, where he died, making his nephew, Hans the Younger, his heir. There is very little doubt that he assisted the elder master in several of his most important works, although no single picture can be traced to him directly.—Ambrosius (c.1494-c.1519), son and pupil of Hans the Elder, was born in Augsburg, and, with his brother, Hans the Younger, was sent to Basel about 1515, when both were engaged chiefly in designing title-pages, initials, and other illustrations for books. In 1517 he was admitted into the guild 'Zum Himmel,' and acquired the freedom of the city in the year following, but all trace of him is lost after 1519. The museum at Basel preserves three authenticated paintings by him: "Christ Crowned with Thorns" and two "Bust Portraits of Boys," besides which the portrait of the goldsmith Georg Schweiger, of Augsburg, may also be attributed to him with tolerable certainty. A portrait of a young man (1518) is in the Hermitage at Saint Petersburg. Consult: The biography of Holbein the Elder, by Stödtner (Berlin, 1896 et seq.); also Woltmann, *Holbein und seine Zeit* (Leipzig, 1873-76).

HOLBEIN, Hans, the Younger (1497-1543). A German painter and designer, one of the chief masters of the German Renaissance. He was a son of Hans Holbein the Elder, and was born at Augsburg, where he studied with his father and with Hans Burgkmair. Two of the works which he probably painted in his father's workshop survive: a "Madonna" (1514), in the Museum of Basel, and "Christ Dragged to the Crucifixion," in the Gallery at Karlsruhe. Both resemble the work of his father, to whom the latter picture has also been ascribed.

About 1515 we find Holbein at Basel, where he and his elder brother Ambrosius had probably come to make illustrations for books; Basel was then an important centre of the book trade. Here Hans was introduced into the classic world, especially through his association with Beatus Rhenanus, corrector for the printer Froben. This influence is revealed in the table-plate in the Museum of Zurich, which he painted for the family Baer, with scenes of hunting, fishing, and knightly tourneys, and in his eighty-three pen drawings for Erasmus's *Praise of Folly,* which are in the Museum of Basel. These drawings are a curious mixture of the coarse style of the fifteenth century and the finer finish of the sixteenth. They show a great master at the beginning of his powers. The Museum of Basel also contains other characteristic works of 1516: a sign for a school-master, on which are painted two school scenes; the portraits of Burgomaster Jakob Meyer, of his wife, and of Hans Herbst, the painter in whose workshop Holbein worked before he became a member of the painters' guild.

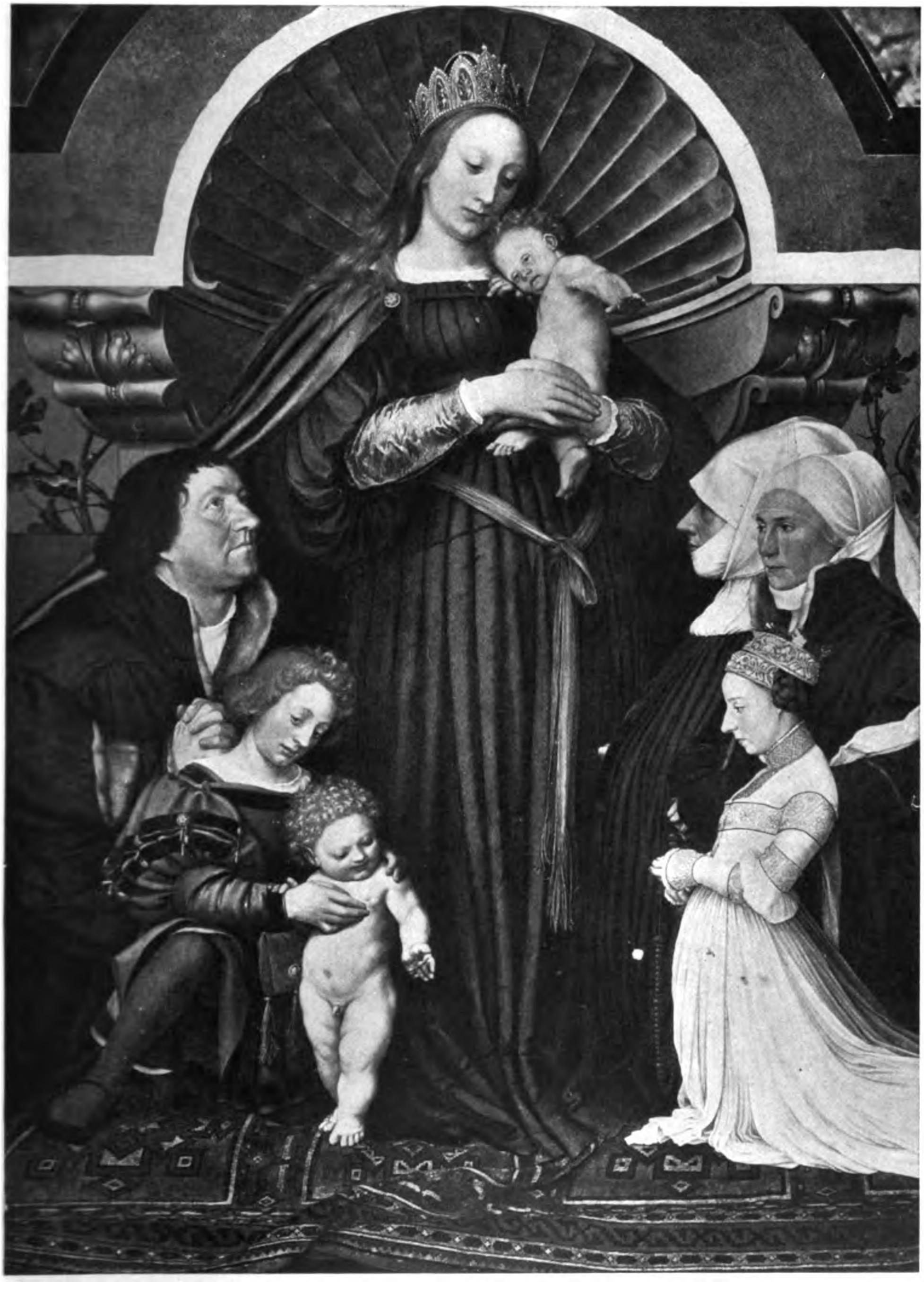
In 1517 he went to Lucerne to decorate the façade and interior of the house of Jakob Hertenstein. These paintings have perished, but the original pen design in the Museum of Basel shows that the façade was decorated with classical subjects, completely in the style of the sixteenth century, and that he was influenced by the study of Mantegna's prints. In 1518 he probably traveled in Lombardy, visiting Milan. The influence of the Lombard school may be seen in Holbein's treatment of form after 1518, and in his "Last Supper" (Basel Museum), which closely resembles Leonardo's masterpiece at Milan.

In 1519 Holbein entered the painters' guild of Basel, and in the following year he became a citizen. During the next few years he decorated the façades of a number of houses at Basel, chief among which was the "Hans zum Tanz," of which the original pen design is in the Museum, with architectural decorations, and a representation of peasants dancing. He also began his extensive decorations of the council chamber, with antique historical subjects representing civic virtue and justice, and with allegorical figures. On the organ doors of the Minster of Basel he painted, in brown monochrome, grandiose figures of saints and angels singing. Among his panel pictures is an altarpiece of "Passion Scenes" of great dramatic power and fine effects of light and shade, and the "Dead Body of Christ" (1521), of striking, almost repulsive realism—all in the Museum of Basel. Among other works of this period is the "Madonna with Saints Ursus and Martin" (1522), in the Museum of Solothurn.

Holbein's best-known work is the "Madonna of Burgomaster Meyer," painted in 1525 or 1526, which holds the same rank in German painting as the "Sistine Madonna" in Italian. The original is in the Gallery of Darmstadt, the Dresden example having been proved to be an excellent copy by a Netherlander of the seventeenth century. Especially fine, in this picture, are the portraits of the kneeling Burgomaster and his family, and the nude figure of his youngest son—a cherub worthy of Correggio.

His portraits of this period include the refined face of Bonifazius Amerbach (1519), the first great German art collector, and three likenesses of Erasmus, who was then a resident of Basel—two in profile, at Basel and in the Louvre, and a larger three-quarter view in Longford Castle. Holbein's mastery of female portraiture is shown in his two allegorical representations of Dorothea Offenburg in the Basel Museum—"The Lais Corinthiaca" (1526), and another portrait in which she is represented with Cupid.

At the same time Holbein was occupied with other forms of design. Among his drawings of the period are two admirable youths, one a pencil, supposed to represent Holbein himself, the other a chalk drawing in the Museum of Basel. One of his favorite subjects was the contemporary German "Lanzknechte" (soldiers), in various actions and attitudes. To the same period belong his drawings of Basler female costumes, which may have been designs for actual use. His designs for glass-painting in the Basel Museum include ten wash drawings of "Passion Scenes," the equals of the painted series mentioned above, Madonnas and other biblical subjects, and coats of arms—all in beautiful Renaissance framing. As a designer for wood-cuts Holbein is second only to Dürer. He left over three hundred blocks, the best of which were cut by Hans Lützelburger. His illustrated Luther's Bible, and his "Histori-



HOLBEIN

"THE MADONNA OF THE BURGOMASTER MEYER," FROM THE PAINTING IN THE DARMSTADT GALLERY

arum Veteris Instrumenti Icones" ("Pictures from the Old Testament"), ninety-one plates, were first published together at Lyons in 1538. Best known of all is his "Dance of Death," fifty-eight plates in all, replete with humor and satire upon the ecclesiastical and social conditions of the day. It was published in book form at Lyons in 1538, and has been often republished; a good modern edition is that of Lippmann (Berlin, 1878).

The advent of the Reformation and the consequent disturbances in Basel were the chief cause of Holbein's journey to England in 1526. Equipped with recommendations from his friend Erasmus, he found a ready welcome in the house of Sir Thomas More at Southwark. His activity during his stay there, which lasted two years, may best be studied in the fine series of chalk drawings at Windsor Castle (published in London, 1884). In 1527 he painted Sir Thomas More, now in possession of Henry Huth, London; Sir Henry Guildford, in Windsor Castle; and Archbishop Warham, of Canterbury, in Lambeth Palace (replica in the Louvre), the best of all—a wonderful piece of realism and strength. Among his portraits of 1528 are those of Nicholas Kratzer, the King's astrologer, in the Louvre, and of Thomas Godsalve and his son John, at Dresden. His famous picture of More and his family is lost, but the studies for the heads are at Windsor, and the pen sketch which he took for Erasmus is still at Basel.

He returned to Basel in 1529 and purchased a house. But during his stay the storm of iconoclasm broke over the city, and the demand for religious pictures ceased. Holbein, indeed, finished his frescoes in the Council Chamber, adding two large subjects from the Old Testament, "Samuel Reproving Saul" and "Rehoboam's Pride." Both paintings are lost, but the sketches in the Museum of Basel, masterly in composition and dramatic action, show Holbein as a great historical painter. In 1529 he painted a highly realistic portrait of his wife and two children on paper (Basel Museum), two portraits of Erasmus (Parma and Basel), and one of Melanchthon (Hanover). In 1532, notwithstanding the efforts of the Burgomaster and Council of Basel to retain him, he returned to England.

On his arrival at London he resided with the German merchants of the Steelyard, with whom he found occupation. In 1532 and in the following years he painted a number of portraits of these merchants, of which examples survive at Vienna, Windsor, Munich, Brunswick, and Petworth. The best is that of George Gysse (1532), in the Museum of Berlin, remarkable for strong character and the detailed finish of the accessories. On the occasion of Anne Boleyn's coronation he designed for the German merchants an allegorical pageant of Parnassus; he decorated their guild-hall with two large paintings, of which there are sketches in the Louvre, "Triumph of Riches" and "Triumph of Poverty." It is not known when he first entered Henry VIII.'s service, but in 1536 we find him mentioned as the King's painter. In 1537 he was sent to Brussels to portray Christina of Denmark, Duchess of Milan, whom the King thought of marrying, and in 1539 to portray Anne of Cleves, whose portrait, now in the Louvre, had much to do with the King's marrying her. His chief work for Henry VIII. was a group painted on the wall of the Privy Chamber at Whitehall, in 1537, representing the King with his father and mother and Jane Seymour. This painting was destroyed in the fire of 1698, but the cartoon of the King is at Hardwick Hall, and there are several copies of the portrait, the best known of which is at Windsor Castle. Holbein painted another excellent portrait of Jane Seymour, now in the Gallery of Vienna, and of Edward, Prince of Wales, at Hanover. The King also commissioned him to design various decorations, especially in the goldsmith's art, in which he acquitted himself with great taste and ability, as is evident from the original designs in the British Museum and elsewhere. In 1538 he visited Basel, where he was banqueted by the council, and he promised to return after two years, which promise, however, he did not keep.

His principal portraits, executed during his last stay in England, besides those mentioned above, are "The Ambassadors" (1533), in the National Gallery; Robert Cheeseman (1533), the King's falconer, at The Hague; Thomas Cromwell, at Tittenhanger; Hubert Morett, at Dresden; Thomas Howard, Duke of Norfolk, at Windsor; two "Unknown Men" at Berlin and Vienna, and an "Unknown Woman" at Vienna; Melchior Maag (1543), in the Huybrecht collection, Antwerp; Dr. John Chambers, the King's physician, at Windsor. He also painted a number of miniatures, among which is that of Queen Catharine Howard in the library at Windsor, and executed a number of important designs for wood-engravings, including the title-page of Coverdale's Bible, illustrations of Cranmer's catechism, and "King Henry in Council," the title-page of Hall's *Chronicle.*

Holbein died of the pestilence in London in the autumn of 1543. He is chiefly known as a portrait painter, but his religious pictures, and especially his mural decorations, show that, had the opportunity presented itself, he might have been one of the greatest historical painters of all times. His portraits are absolutely true to nature, yet show a wonderful interpretation of character. The excellence of his drawing is attested by his large number of chalk and other drawings, especially in the Museum of Basel and in Windsor Castle. His method in portraiture seems to have been to make a careful chalk drawing of the sitter, which he afterwards transferred to the canvas. Holbein is by far the greatest colorist of the German school, and although the details of his portraits are highly finished, they in no wise interfere with the general effect. As a designer for wood-engraving he showed a thorough understanding of the art, combined with a fantasy and humor which have seldom been surpassed.

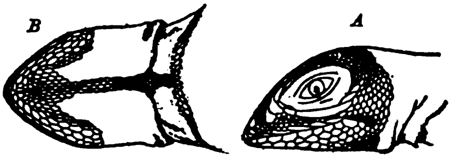
Consult: Woltmann, *Hans Holbein und seine Zeit* (Leipzig, 1874-76); Wornum, *Life and Works of Holbein* (London, 1866); A. Schmid, *Holbein des Jüngeren Entwickelung 1515-26* (Basel, 1892). See also the biographies of Cundall (London, 1879); Knackfuss (Bielefeld, 1897); and of Wessely, in Dohme's *Kunst und Künstler Deutschlands* (Leipzig, 1877). For reproductions of Holbein's works, compare Mantz, *Hans Holbein* (Paris, 1879); Hiis, *Dessins d'ornements de Hans Holbein* (ib., 1886).

HOLBERG, hŏl′bĕrk, Ludvig, Baron (1684-1754). A Danish poet, novelist, and historian, born at Bergen, Norway. He is called the 'father of Danish comedy.' Left an orphan in childhood, he proved an eager student in spite of poverty and discouragements, and supported himself precariously as tutor for some years, in the course of which he visited Holland, Germany, and England, and studied for two years at Oxford. He lectured in the University at Copenhagen, where his scholarship was recognized, though not remunerated. Some historical studies in manuscript attracted the attention of King Frederick IV., and Holberg received a traveling scholarship that took him through a great part of Europe, largely on foot. He returned to Denmark in 1716, and in 1718 published *An Introduction to Natural and Popular Law,* which brought him a professorship in the University of Copenhagen and a modest competence. Thus eased, his genius welled up in the seriocomic epic *Peder Paars* (1719), a brilliant satire on contemporary manners, followed by five others, hardly less successful. In 1721 he was made director of the first Danish theatre in Copenhagen, for which he wrote during 1722 five classic comedies and in 1723 ten others. His best comedy, *Henrik and Pernille,* belongs to 1724. The theatre failed, and Holberg closed his dramatic career by publishing his collected comedies in 1731. Adapting himself to a change in the national spirit, he turned to history, philosophy and satire, writing much that is now forgotten, and also the famous satire, *Subterranean Journey of Niels Klim* (*Nicolai Klimii Iter Subterraneum,* 1741), which was thrice translated from Latin into Danish, ten times into German, three times into Swedish, English, and Dutch, twice into French and Russian, and once into Hungarian. He published also five volumes of *Letters* (1748-54). He shares with Voltaire the preëminence in European literature in his generation. He made Danish a literary language, and won for it aristocratic recognition. His influence has endured for two centuries. Editions of his works are countless; the best edition of the *Comedies* is by Lichtenberg (Copenhagen, 1884 et seq.). The Holberg Society, founded at Copenhagen in 1842, oversaw (1848-54) a critical edition of Holberg's comedies in eight volumes. There are biographies by Prutz (Stuttgart, 1857); Smith (Copenhagen, 1858); and Horn (ib., 1884). Consult also: Legrelle, *Holberg considéré comme imitateur de Molière* (Paris, 1864); Brandes, *Holberg und seine Zeitgenossen* (Berlin, 1885).

HOLBORN, hō'bŭrn. A district and street in London. The name is derived from Old or Hole Bourne, the former name for a part of the Fleet, which ran through a valley. The depression is now crossed by the famous Holborn Viaduct, an iron structure 27 yards wide and 657 long, built in 1869 to facilitate communication by avoiding the ascent of Holborn Hill. Criminals formerly passed through Holborn on their way to execution, and according to an old custom received a nosegay at Saint Sepulchre's Church, near Newgate Prison, from which the thoroughfare leads west to New Oxford street. On Holborn are Barnard's, Furnivall's, and Staple Inn, and near it are Ely Chapel, Gray's Inn, and Lincoln's Inn. Milton at one time lived on the western portion of the street, called High Holborn. A number of picturesque old houses stand on this street, which survived the Great Fire.

HOL'BROOK, John Edwards (1794-1871). An American naturalist, born in Beaufort, S. C. He graduated at Brown in 1815, and in medicine at the Pennsylvania University three years later, studied afterwards in Europe, and began practice in Charleston in 1822. In 1824 he was made professor of anatomy in the South Carolina College. This position he retained for more than thirty years. The outbreak of the Civil War put an end to the publication of his *Ichthyology of South Carolina,* begun in 1854. His previous work upon *American Herpetology* (5 vols., 1842) was highly commended by Agassiz and others.

HOL'BROOK'IA (named in honor of the American naturalist J. E. Holbrook). A genus of iguanid lizards of the Southwestern United States and Northern Mexico, especially characteristic of the Rio Grande Valley. The four species are of moderate size, with short legs, squat depressed bodies, covered with minute scales, and long tails. The general color is gray, and all are blotched, spotted, and barred (on the tail) with darker tints, but the colors are highly variable; hence they are popularly known as 'spotted lizards.' They prefer rocky ground, and run swiftly with their tails curved over their backs. They subsist mainly on insects, worms, and the like, but also take vegetable food. They make interesting pets. When placed in a fly-trap they pick out the very large, black, and bright-colored flies before eating the house-flies. See Iguana.



HOLBROOKIA MACULATA.
a, top of head; *b,* profile.

HOLCROFT, hōl'krŏft, Thomas (1745-1809). An English dramatist and novelist, born in London. The son of a shoemaker, he learned his father's trade; later he was a stable boy, a schoolmaster, an actor, and lastly a playwright. He wrote thirty plays, the best and most successful of which is *The Road to Ruin* (1792), still occasionally acted. During the French Revolution he became a member of the Society for Constitutional Information, and was indicted for high treason, imprisoned, and finally discharged without trial. He was a man of great industry. He learned French, German, and Italian, and translated many works, including Goethe's *Hermann und Dorothea,* Lavater's *Physiognomische Fragmente,* and some of the works of Frederick the Great. He was also the author of four novels and numerous poems. His *Memoirs,* written by himself or compiled from his diary and other papers, by William Hazlitt, were published after his death (3 vols., 1816).

HOLCUS. See Soft Grass.

HOLD (older form *hole,* from Dutch *hol,* hole, hold; connected with AS., OHG. *helan,* Ger. *hehlen,* Lat. *celare,* Gk. *καλύπτειν, kalyptein,* to hide, OIr. *celim,* I hide; confused in popular etymology with *hold,* to contain). That portion of the interior of the ship which is below the upper deck. This part of a ship may be divided into several parts, as the *fore-peak*, the *fore-hold*, the *main-hold*, the *after-hold*, the *engine* and *boiler rooms*, *coal-bunkers*, *store-rooms*, etc. To *stow* a hold is to put things in it and arrange them properly; to *break out* a hold is to remove the contents of it.

HOLD. In music, a sign placed above (𝄐) or below (𝄑) a note or rest to indicate that its time-value is increased. The length of a hold is governed by the rhythm of the music, and is left to the performer's discretion. See General Pause.

HOLDEFLEISS, hôl′de-flīs, Friedrich Wilhelm (1846—). A German agricultural chemist. He was born at Bennstedt, and studied at Halle, where for several years he acted as assistant in the Agricultural Experiment Station and in the Agricultural Institute of the university. In 1878 he was appointed director of the agricultural station of the Central Silesian Agricultural Society at Breslau. In 1881 he became professor extraordinary and in 1882 ordinary professor of agricultural chemistry in the Agricultural Institute of the University of Breslau. After filling this position with distinction for ten years he was appointed director of the Institute. During his incumbency he was actively engaged in the preparation of numerous works dealing with his specialty. Among these may be mentioned: *Untersuchungen über den Stallmist* (Breslau, 1889); *Das Knochenmehl* (Berlin, 1890); *Die Rinderzucht Schlesiens* (Breslau, 1896); *Schatzkästlein des praktischen Landwirts* (Berlin, 1896).

HOL′DEN, Albert J. (1841—). An American organist and composer of Church music. He was born in Boston, studied music in New York, where he made his home in 1855, and became organist in the Universalist Church of the Divine Paternity and the Church of the Puritans (Congregationalist). His musical compositions include ballads and secular as well as sacred part-songs and choruses, but he is best known as the composer of more than three hundred hymn tunes, anthems, and the like. He also edited collections of music.

HOLDEN, Edward Singleton (1846—). An American educator. He was born in Saint Louis, Mo., and received his education at Washington University, Saint Louis, and at West Point, where he graduated in 1870. He occupied successively the positions of professor of mathematics, United States Navy; astronomer at the United States Naval Observatory, Washington, D. C.; director of the Washburn Observatory, Madison, Wis.; president of the University of California; and director of the Lick Observatory. His most important work was that done at the Lick Observatory, Cal., with which he was connected for twenty-eight years, and most of the buildings and instruments of which were designed and built under his direction. He founded the Astronomical Society of the Pacific, and wrote several works on astronomy, history, and education. In recognition of his services, numerous honors were bestowed upon him, both in this country and by the governments of several European States.

HOLDEN, Sir Isaac (1807-97). A British inventor, who produced lucifer matches and improved wool-carding machinery. He was born in Hurlet, Renfrewshire, of English parents, and from being a draw-boy to hand-weavers, he went into a Paisley cotton-mill, educating himself meanwhile till he was able to teach school. In the course of experimenting for a chemistry class, he discovered the efficiency of lucifer for matches (1829), but, as he took out no patent, others reaped the benefit of his invention. He was next bookkeeper, then manager, then owner of a wool-combing mill, and made such important improvements in its machinery that he became a wealthy manufacturer. He was also a member of Parliament, but in neither position did he forget the interests of the working men from whose ranks he had sprung.

HOL′DER, Charles Frederick (1851—). An American naturalist. Born in Lynn, Mass., of Quaker parents, he was sent to the Friends' School in Providence, R. I., afterwards to a seminary near Boston, thence to the United States Naval Academy, at Annapolis, but followed his natural bent toward science, and became assistant curator of zoölogy in the American Museum of Natural History, New York City (1871-75). He spent some time collecting specimens in different parts of the country for the Aquarium at New York City, and was lecturer in the city schools as well as a writer upon scientific subjects for young people. After his removal to California, he took a prominent part in educational affairs, was made president of the Pasadena (Cal.) board of education, and trustee of, and professor of zoölogy in, Throop University. His publications include: *Marvels of Animal Life* (1880); *Elements of Zoölogy* (1885); *Living Lights* (1887); *The Ivory King* (1888); *A Frozen Dragon* (1888); *A Strange Company* (1889); *Around Pasadena* (1889); *The Pasadena Highlands* (1889); *Santa Catalina Island, Its Sports* (1889); *Louis Agassiz, His Life* (1892); *Charles Darwin's Life and Work* (1893); *The Treasure Divers* (1889); *Stories of Animal Life* (1900); *Big Game at Sea* (1901); and *Half Hours with Nature* (5 vols., 1901).

HÖLDER, hĕl′dĕr, Eduard Otto (1847—). A German jurist, especially versed in Roman law. Born at Stuttgart, he studied at Tübingen, and became professor at Zurich (1872), Greifswald (1874), Erlangen (1880), and Leipzig (1893). His works include: *Institutionen des römischen Rechtes* (3d ed. 1893); *Zum allgemeinen Teil des Entwurfs eines deutschen bürgerlichen Gesetzbuchs* (1888); *Pandekten* (1886-91); *Ueber objektives und subjektives Recht* (1893); *Die Stellung des römischen Erben* (1895); with Schollmeyer and others, he undertook the preparation of the *Kommentar zum deutschen bürgerlichen Gesetzbuch* (1899 et seq.).

HÖLDERLIN, hĕl′dĕr-lēn, Johann Christian Friedrich (1770-1843). A German poet, born at Lauffen, and educated at Tübingen, where he knew Hegel and Schelling. He was private tutor in the house of Schiller's friend, Charlotte von Kalb (1793-94), and then at Frankfort, where the mother of his young charges, Frau Gontard, inspired him with a platonic passion, which led him to celebrate her under the name of Diotima in his *Hyperion*. But from this time on his mind began to fail, and, save for intervals of sanity, he never recovered. His style was classic; his thought, in his best work, deep and full. He wrote: *Hyperion, oder der Eremit in Griechenland*, a romance in epistolary form (1797-99);

an incomplete drama, *Empedokles;* translations from Sophocles's *Œdipus* and *Antigone* (1804); and the *Lyrische Gedichte,* mostly elegiac in tone, edited by Uhland and Schwab (4th ed. 1878; in 1899, by Linke). A complete edition of his works, with his letters and biography by Schwab, appeared at Stuttgart (1846). Consult: Milbrandt, *Friedrich Hölderlin* (Berlin, 1896); Müller-Rastatt, *Hölderlin, sein Leben und sein Dichten* (Bremen, 1894); and Klein-Hattingen, *Das Liebesleben Hölderlins, Lenaus, Heines* (Berlin, 1900).

HOLDING (Lat. *tenementum,* a tenement, something held, from *tenere,* to hold). In Scotch law, an estate held of a superior, under the feudal system of land tenure. It corresponds to the terms 'tenement' and 'tenure' in English and American law. See also ESTATE; FEE; FREEHOLD.

HOLE, WILLIAM (1846—). An English painter and engraver. He was born at Salisbury, and was educated for an engineer at the Edinburgh Academy and University, but an Italian journey having inspired him with a desire to be an artist, he studied at the Edinburgh school, and became associate (1878), and full member (1889) of the Royal Scottish Academy. Aside from portraits, Hole's best paintings are: "The End of the Forty-Five" (1879); "The Eve of Culloden" (1880); "If Thou Hadst Known" (1884); "News of Flodden" (1886); but he is more famous as an etcher, having made excellent reproductions of the masterpieces of Millet, Constable, Velazquez, Millais, Thomson of Duddingston, and others. In his later years he turned to fresco painting, and his work is to be seen in Saint James Church, and in the National Portrait Gallery, Edinburgh.

HOLGUIN, ŏl-gēn′. A city of Cuba, in the Province of Santiago de Cuba, and capital of the department of the same name, about 25 miles by rail from Gibara, its port (Map: Cuba, J 6). It is regularly built with several open squares and streets crossing at right angles, and it has a number of fine buildings. It exports tobacco, timber, corn, and cattle. It was founded in 1720, and received the title of city in 1751. Population, in 1899, 6,045.

HOLIBUT. See HALIBUT.

HOLIDAY (AS. *hālig dæg,* holy day). A day set apart as a religious anniversary, or for the purpose of commemorating some extraordinary event, or of honoring the memory of a distinguished person. As a rule, holidays are occasions for rejoicing. People are expected to observe them "with the voice of joy and praise." (Ps. xlii. 4.) At times, however, they are accompanied by fasts rather than feasts. Of this character are days of humiliation and prayer, such as Fast Day, formerly observed in Massachusetts and other New England States, and days specially appointed from time to time by proclamation of Government authorities or of ecclesiastical dignitaries.

During the Middle Ages holidays became so numerous, in many parts of Europe, as to interfere seriously with industrial pursuits. One of the most important results of the religious reformation of the sixteenth century was the abolition of excessive holidays with its consequent increase in the volume of secular labor. The present tendency in this country appears to be toward the multiplication of legal holidays.

Many occasions are observed by Church or social or political organizations as holidays which are not declared holidays by law. A legal holiday is one set apart, either by common or by statute law, as a day of rest, or of cessation in whole or in part from ordinary business activities. Sunday is the only common-law holiday in this country, although Good Friday has been recognized as such in England for centuries. Legal holidays are of two kinds, general or public, and special or limited. On a public holiday, such as Sunday or the Fourth of July, public offices are closed, and persons under contract to render services are not bound to work for their employers. If they do labor at the request of their employers, they are entitled to extra pay. In England, and in many of our States, persons are prohibited from carrying on secular business or making contracts during Sunday. (See the article SUNDAY.) On special or limited holidays, such as some of the bank holidays (q.v.), exemption from labor and from the performance of contracts generally is confined to a particular class of employees or to a designated section of the community, or to specified contracts.

As a nation, we have no legal holiday, although Congress has appointed special holidays from time to time, and in the District of Columbia has made Labor Day a public holiday. It is customary for the President to appoint annually the last Thursday of November as a day of thanksgiving, but its observance as a legal holiday is dependent upon State and Territorial legislation. At present there are about thirty different legal holidays recognized by our various States. Some of them, like the anniversary of the battle of New Orleans (Louisiana), Bennington battle day (Vermont), Patriots' Day (Massachusetts), and Lincoln's Birthday (New York), are confined to a single commonwealth; while others, like Christmas Day and the Fourth of July, are observed throughout the Union. Consult: *Brooklyn Daily Eagle Almanac* (1902, p. 52); *Thoughts for the Occasion* (New York, E. B. Treat, 1894); "Origin of Holidays," 34, *Popular Science Monthly,* 516 (1889); "American Holidays," 62, *Saturday Review,* 19 (1886); Manners, *A Plea for National Holy Days* (London, 1843); "The Holidays," 32, *Harper's Magazine,* 164, 358 (1866); "Bank Holidays," 22, *Journal of the Institute of Bankers* (London, 1901); "What Should Our National Holidays Commemorate?" 15, *Massachusetts Historical Society,* second series, 506 (1902).

HOLINSHED, or **HOLLINGSHEAD,** hŏl′ĭnz-hĕd, RAPHAEL (?-1580). An English chronicler. Little is known of his life save that he was of a Cheshire family, probably the son of Ralph Holinshed of Cophurst, in the township of Sutton Downes. He is celebrated as the author of a history of England, Scotland, and Ireland, which the Elizabethan dramatists drew upon for material in the construction of their historical plays. The work had been started originally by Wolfe, who, however, died in 1573 before its completion. Thereupon Holinshed undertook the work, and in 1578 appeared *Raphael Hollingeshed's Cronycle,* in two folio volumes. Holinshed had been assisted by William Harrison, who wrote the historical descriptions of England

and Scotland, and by Richard Stanihurst, who contributed a part of the history of Ireland. All copies of the work were printed by Henry Bynneman. The publishers were George Bishop, John Harrison, and Luke Harrison. A second edition appeared in 1587, after Holinshed's death. This edition was chiefly revised by Hooker, and contained some passages disagreeable to Elizabeth, who immediately ordered them cut out. A modern edition in six volumes was published in London (1807-08), with the 'disagreeable passages' restored. But after all Holinshed's *Chronicle,* though popular in its day, would be seldom recalled to-day were it not for Shakespeare's indebtedness to it. From it the data for most of the great historical plays were probably derived; and in *Macbeth, Lear,* and *Cymbeline* most of the borrowed action and dialogue can be illustrated by excerpts from Holinshed. Consult: Cooper, *Athenæ Cantabrigienses* (Cambridge, Eng., 1858); Boswell-Stone, *Shakespere's Holinshed* (New York, 1896).

HOLKAR, hŏl′kär. The name of a powerful Mahratta family, later adopted as a title by the rulers of Indore, one of the native States of Central India. The founder of the family was Mulhar Rao Holkar, who was born in the Deccan in 1693, and having gained by his valor the favor of the Peshwa (q.v.), obtained from him the western half of Malwa, with Indore for his capital. In 1761 he joined the great league of the princes of Hindustan, formed to bar the progress of Ahmed Shah Durrani, and was present at the battle of Panipat, January 6, 1761; but as he fled shortly after the battle began, he was suspected of treason. Holkar was the only Mahratta chief of note who escaped the slaughter. He died in 1768, and was succeeded by his grandson Malli Rao, who died soon after. The government then passed to Aylah Bade, the mother of Malli Rao, who resigned the military power to Toghaki Holkar. On his death in 1797 his natural son, Jeswunt Rao Holkar, a man able, brave, and unscrupulous, seized Indore, but was driven out by Sindia (q.v.). Such, however, was Holkar's reputation for energy and ability that part of the victorious army deserted to him, with whose aid he obtained a signal victory over Sindia and the Peshwa (October, 1802). After fighting a long time against the British with varying success, he was compelled to conclude peace. He died insane October 20, 1811. His son, Mulhar Rao Holkar II., a minor, succeeded, and in 1817 declared war against the British, but his army was totally routed at Mahedpore, December 21st; whereupon he sent offers of peace, which were accepted, and an English residency was established at Indore in January, 1818. He died in 1833. Martund Rao Holkar, Hurri Rao Holkar, and Kumdi Rao Holkar successively ruled after him. The last of these died without heirs in 1843, and the East India Company assumed the right of nominating Tukagi Rao Holkar, who did not belong to the Holkar family. He was educated under the auspices of the British Government, and displayed great ability, and always remained on the most friendly terms with the British. In 1886 he was succeeded by his eldest son, Shiraji Rao Holkar.

HOLKAR'S DOMINIONS. See INDORE.

HOLL, FRANK (1845-88). An English painter. He was born in London, July 4, 1845, a son of a well-known engraver. He was admitted as a student at the Royal Academy, 1860. He received a prize for the best drawing from the antique, 1862, and another for the best historical painting, "Abraham's Sacrifice" (1863). He exhibited at the Royal Academy: "Turned Out of Church" (1864); "A Fern Gatherer" (1865); "The Ordeal" (1866); "Convalescent" (1867). His picture "The Lord Gave and the Lord Hath Taken Away" gained him the two years' traveling studentship for painting, 1869. Among his other works exhibited are: "No Tidings from the Sea" (1871), which was painted for Queen Victoria; "I am the Resurrection and the Life" (1872); "Deserted" (1874); "Her First-Born" (1876); "Committed for Trial" (1878); "The Gifts of the Fairies" (1879); "Ordered to the Front" (1880); "Home Again" (1881); and "Millicent" (1883). In 1879 he took up portrait painting, in which he achieved high success, being excelled only by Sir John Millais (q.v.) among his contemporaries. He united strong characterization with brilliancy of color. Among his sitters were the Prince of Wales, Lord Wolseley, the Duke of Cambridge, John Bright, the Marquis of Dufferin, Joseph Chamberlain, Sir John Millais, William Ewart Gladstone. Holl was elected academician in 1883, and received medals at Philadelphia in 1876, and at Melbourne. He died in London, July 14, 1888.

HOLLAND. A mediæval county, whose territories now form the provinces of North and South Holland (qq.v.), in the Kingdom of the Netherlands. The hereditary counts of Holland, whose dominions were included within the limits of the Holy Roman Empire, appear in history as early as the tenth century. Count William II. was elected Roman Emperor in 1247 in opposition to Frederick II. He contested the Imperial crown with Conrad IV., Frederick's successor, and on the death of Conrad in 1254 was recognized by the German princes. He was slain in a war with the Frisians in 1256. In 1299 Holland passed to the counts of Hainault. Soon after, Zeeland was permanently united with Holland. In 1433 Countess Jacqueline made over Hainault, Holland, and Zeeland to Philip the Good of Burgundy. Holland shared the fortunes of the united Netherlands and was one of the provinces which achieved their liberation from Spain and constituted themselves into the Dutch Republic. See BURGUNDY; NETHERLANDS.

HOLLAND. A city in Ottawa County, Mich., 25 miles southwest of Grand Rapids; at the head of Black Lake, which affords a good harbor, having regular steamboat lines to Milwaukee and Chicago, and also on the Père Marquette Railroad (Map: Michigan, G 6). It is the seat of Hope College, opened in 1865, and of the Western Theological Seminary, both under the control of the Reformed Church in America, and has a public library. There are several summer resorts on the shore of Black Lake that enjoy considerable popularity. Holland carries on an extensive grain trade, and is a manufacturing centre of importance, its industries including flour and planing mills, tanneries, furniture, veneer, tub, and basket factories, a beet-sugar factory, a large pickling plant, and establishments for the manufacture of wood-working machinery, and electric and steam launches. The water-works and electric-light plant are owned by the municipality. Founded in 1847 by Dutch settlers, Holland was chartered as a city in 1867. Its inhabitants are still largely of Dutch descent. Population, in 1890, 3945; in 1900, 7790.

HOLLAND. A variety of unbleached linen cloth used largely for window-shades and in upholstery for covering furniture. The name is derived from the fact that it was first manufactured in Holland. See LINEN.

HOLLAND, EDMUND MILTON (1848—). An American comedian, born in New York City, the son of George Holland, who was also a well-known actor. He appeared upon the stage in childhood, but his regular professional career began in 1866 at Barnum's Museum. The next year, under the name of Mr. E. Milton, he became a member of Wallack's company, with which he played successfully in *The Road to Ruin*, *Caste*, and other pieces till 1880. After an interval, during which he made a tour in England, he was engaged in 1882 at the Madison Square Theatre. Among his characters in the years that followed were Pittacus Green in *Hazel Kirke*, Old Rogers in *Esmeralda*, Captain Redwood in *Jim the Penman*, and Colonel Carter in *Colonel Carter of Cartersville*, the last-named at Palmer's Theatre. Beginning in 1895 he and his brother Joseph starred for about two years in *A Social Highwayman*, and other plays. Two of his more recent rôles were those of Leopold Kolditz in *Hearts are Trumps* (1900), and *Eben Holden* (1901). Consult: McKay and Wingate, *Famous American Actors of To-Day* (New York, 1896); Strang, *Famous Actors of the Day in America* (Boston, 1900).

HOLLAND, Sir HENRY (1788-1873). An English physician, natural philosopher, and author, born at Knutsford, England. He was educated at London and Edinburgh, receiving his medical degree at the University of Edinburgh in 1811. He traveled extensively during his life; practiced medicine from 1815 till his death; was elected fellow of the Royal College of Physicians in 1828; physician-in-ordinary to the Prince Consort in 1840, and in 1852 to Queen Victoria; was made a baronet in 1853; and was very prominent medically, socially, and in literary circles. He was the author of *Medical Notes and Reflections* (1840); *Chapters on Mental Physiology* (1852); *Essays on Scientific Subjects* (1862); and *Recollections of a Past Life* (1871).

HOLLAND, HENRY FOX, Baron (1705-74). An English politician. He was the younger son of Sir Stephen Fox. He was elected to Parliament as a Whig in 1735, and two years later was appointed surveyor-general of works by Walpole. After his chief's fall he was Lord of the Treasury (1743), and Secretary of War (1746). In 1755 he was bribed by a seat in the Cabinet to back George II.'s measures, and quickly became leader of the House. But in 1756 he resigned, and a year later he entered upon the lucrative office of Paymaster-General. Grenville's resignation in 1762 made him again leader of the House of Commons. The task of getting the Peace of Paris approved he accomplished by wholesale corruption and browbeating (1763); but made himself so unpopular that he gladly resigned. He kept the Paymaster-Generalship until 1765. The Court of Exchequer brought proceedings against him, and the Mayor of London (1769) spoke of him in a petition to George III. as "the public defaulter of millions," but he had served the King so well that all attacks were unsuccessful even when he was out of favor at Court.

HOLLAND, HENRY RICHARD VASSALL FOX, Lord (1773-1840). An English politician, son of Stephen, second Lord Holland, and nephew of Charles James Fox. He entered the House of Lords in 1798, and won especial fame by his protests, later collected by Moylan: *The Opinions of Lord Holland, 1797-1840* (1841). He was soon recognized as a power in the Whig Party, and fought against suspension of the Habeas Corpus Act, against the union with Ireland, and for the repeal of the Test and Corporation Acts. He was a commissioner (1806) to negotiate a treaty with America. When his uncle died he was a member of the privy council, and was a member of the Cabinet of 1806 as Lord Privy Seal. When his party was restored to power in 1830 he became chancellor of the Duchy of Lancaster. He is best known, perhaps, as the host of Holland House, and the centre with Lady Holland of the brilliant company that gathered there. Besides his important *History of the Whig Party During My Time*, edited by his son (1852), he wrote: *Some Account of the Life and Writings of Lope Felix de Vega Carpio* (1806). His *Foreign Reminiscences* (1850) gives vivid, but not entirely trustworthy, pictures of his times.

HOLLAND, HENRY SCOTT (1847—). An English preacher and theologian, born at Ledbury in Herefordshire. He was educated at Eton and Oxford, was made canon (1844), and precentor (1886) of Saint Paul's Cathedral, London. His publications include several volumes of sermons, such as *Logic and Life* (1882).

HOLLAND, JOSIAH GILBERT (1819-81). An American journalist and author, born at Belchertown, Mass., July 24, 1819. He graduated at Berkshire Medical College, Pittsfield, Mass., in 1844, practiced medicine three years, was made school superintendent at Vicksburg, Miss., became assistant editor of the Springfield *Republican* (1849-66), and made that journal attain great influence in New England. Here he published his *History of Western Massachusetts* (1855), and during these years gained distinction as a popular lecturer. On his return from two years in Europe (1868-70), he founded *Scribner's Monthly*, which absorbed successively *Hours at Home*, *Putnam's Magazine*, and *Old and New*, and, under changed ownership, is the present *Century Magazine*. Of this he remained editor till his death in New York, October 12, 1881. Of his many volumes of fiction and verse, the earlier were published under the assumed name of Timothy Titcomb. The more noteworthy of the novels are: *The Bay Path* (1857); *Miss Gilbert's Career* (1860); *Arthur Bonnicastle* (1873); *The Story of Seven Oaks* (1875); and *Nicholas Minturn* (1876). Of the poems the most popular are: *Bittersweet* (1858); *Kathrina* (1867); and *Garnered Sheaves* (1873). Noteworthy also are *Letters to Young People* (1858); *Letters to the Joneses* (1863); *Plain Talk on Familiar Subjects* (1865); *Life of Lincoln* (1865); and *The Mistress of the Manse* (1874). His prose and verse are alike clean in diction and thought, pure and sweet in feeling, earnest in moral tone, and appeal to a wide circle of readers. For his *Life,* consult Plunkett (New York, 1894).

HOLLAND, Philemon (1552-1637). A native of Chelmsford, England, called by his contemporaries 'the translator-general of his age.' He was educated at Trinity College, of which he became a fellow. On being appointed to the rectorship of the free grammar-school of Coventry, he began a long series of translations from the classics. He also found time to carry on practice as a physician. By distribution of his time he reconciled his three professions of schoolmaster, doctor, and translator, fulfilling the functions of all three till his eightieth year. His chief translations are those of Livy, Pliny's *Natural History*, Plutarch's *Morals*, Suetonius, Ammianus Marcellinus, and the *Cyropædia* of Xenophon. He also did good service to literature by his edition of Camden's *Britannica*, to which he made some valuable additions.

HOLLAND, Thomas Erskine (1835—). An English jurist of prominence. He was born at Brighton, studied there and at Balliol and Magdalen Colleges, Oxford, where he won high honors, and entered practice in 1863. In 1874 Holland became Vinerian reader of English law at Oxford, and immediately afterwards was appointed Chicele professor of international law and diplomacy. The wide recognition of his merits in this field may be seen from the fact that Holland was given the degrees of D.C.L. from Oxford and LL.D. from Bologna, Glasgow, and Dublin, and from his membership in the University of Saint Petersburg and an honorary professorship at Perugia. His best known work, *Elements of Jurisprudence* (1880, 9th ed. 1900), is a standard in England and America. He also wrote: *The Institutes of Justinian* (1873-81); *The European Concert in the Eastern Question* (1885); and *Studies in International Law* (1898).

HOL′LANDER, Jacob Harry (1871—). An American economist, born in Baltimore, and educated at Johns Hopkins University. He was appointed secretary to the Bimetallic Commission of 1897; in 1900 the Secretary of War made him special commissioner on the revision of law in Porto Rico, and a few months afterwards he was named treasurer of the island by President McKinley. He served as associate professor of finance in Johns Hopkins, and recording secretary of the American Jewish Historical Society. His publications include: *The Cincinnati Southern Railway, a Study in Municipal Activity* (1894); *The Financial History of Baltimore* (1899); and *Studies in State Taxation* (1900); and he edited the *Letters of David Ricardo to J. R. McCulloch* (1895), and to *Hutches Trower* (1899).

HOLLAND HOUSE. A London mansion of Tudor architecture, on a hill near Kensington Gardens, built in 1607 for Sir Walter Cope. Its name is derived from an early owner, Henry Rich, Earl of Holland. The house is famous for its associations with the names of those who have occupied it. After Lord Holland's execution it passed into the hands of the Parliamentary generals Fairfax and Lambert, but was later restored to Lady Holland. Addison lived in it from 1716 to his death in 1719. Henry Fox, father of Charles James Fox, purchased it in 1762, and it is still in the possession of his line. Among its other inmates have been Cromwell, Ireton, William Penn, William III. and Mary, Moore, and Macaulay.

HOLLAND PURCHASE. See New York.

HOLLAND SOCIETY. A patriotic society, founded in New York City on April 6, 1885. Its objects are to collect information respecting the early history and settlement of the city and State of New York by the Dutch, and to discover and preserve all existing documents, mementos, etc., relating to their genealogy and history, as well as to publish material for a memorial history of the Dutch in America, in which shall be particularly set forth the part belonging to that element in the growth and development of American character, institutions, and progress. The society admits to membership descendants, in the male line only, of a Dutchman who was a native or resident of New York, or of the American Colonies, prior to the year 1675. The insignia is an oval medallion with the head of William the Silent in relief. The society has marked various historical localities in New York City by inscribed brass plates; and publishes volumes containing historical information. Its membership is upwards of 1000.

HOLLAR, hôl′lär, Wenceslas (in Bohemian, Vaclav Holar) (1607-77). A celebrated etcher and engraver. He was born at Prague, June 13, 1607, the son of a lawyer, and received a good education. He studied engraving under Matthew Marian, a pupil of Rubens and Van Dyck. He was only eighteen when he published his first works, consisting of the "Virgin," the "Ecco Homo," and some other subjects. Leaving Prague, he began a wandering life through Germany, taking views of the chief towns and of the most striking scenery of the Danube, Rhine, and other streams. He lived two years at Frankfort, and afterwards in Cologne and Antwerp. At Cologne in 1635 he fell in with the Earl of Arundel, the English Ambassador to the German Emperor, who attached him to his service. Soon after reaching England with his patron he was appointed to instruct the Prince of Wales in drawing; and in 1640 published his *Ornatus Muliebris Anglicanus*, a description of the customs of the contemporary Englishwomen, followed in 1643 by *Theatrum Mulierum*, a similar production for the women of the remaining parts of Europe. During the Civil War he enlisted as a Royalist, and in 1645 he joined Lord Arundel at Antwerp. After Arundel's death he became very poor. He worked by time, fixing his tariff at fourpence an hour, which he marked by a sand-glass. During this period, however, he produced his best work. He returned to England in 1652, and worked with the same unflagging industry, and with no more profitable result. His plates in Dugdale's *Monasticon* and *History of Saint Paul's* and in other works attest his diligence. After the Restoration he was made designer to the King, and in 1669 he was commissioned by Charles II. to take plans and perspective drawings of Tangier and its fortifications, in payment for which work he received a very paltry sum. In 1673 he traveled through Northern England, etching the principal cities there. He died in great poverty in London, January 19, 1677.

He left over 2700 plates on a great variety of subjects. They include views of cities, such as Strassburg, Frankfort, Cologne, Oxford, Lincoln, and York, Albury, Windsor, Tangier, etc.; architectural drawings, like Antwerp Cathedral, Saint George's Chapel, Windsor; tomb of Edward IV., Windsor; and other subjects, like "Trial of Archbishop Laud," "Coronation of Charles II.," "Engagement with the Algerian Pirates," the "Four Seasons." His portraits were largely after Holbein, and especially Van Dyck. Among the best known are those of Charles I. and his Queen after the latter, and his original engravings of the Duke of York (afterwards James II.), Oliver Cromwell, Hobbes, and Lady Venetia Digby. While most of his work was original, he executed with equal facility engravings after the old masters. Some of the best known are an "Ecce Homo," after Titian; "Esther Before Ahasuerus," after Veronese; "Cupid Riding a Lion," after Giulio Romano; and especially a beautiful goblet after Mantegna's pen drawing. There are almost complete collections of his works in the British Museum and in the library of Windsor Castle.

Hollar's work unites, in a remarkable fashion, accuracy and the pictorial quality. He endeavored to render detail rather than character; but his technical excellence was unsurpassed in his day. His process was peculiar, being mostly done with the etching needle.

Consult: The catalogue of Hollar's plates by Vertue (London, 1759), and by Parthey (Berlin, 1853, supplement 1858). The former contains valuable biographical notices; the latter is an excellent and exhaustive treatise.

HOLLAZ, hŏ′läts, David (1648-1713). A German dogmatic theologian, born in Pomerania. He studied at Erfurt and Wittenberg; became preacher at Pützerlin in 1670, assistant rector at Stargard in 1680, and afterwards was situated at Kolberg and at Jakobshagen. His great work, *Examen Theologicum Acroamaticum Universam Theologiam Thetico-polemicam Complectens* (1707), passed through many editions, and surpassed preceding works in clearness and simplicity rather than scientific knowledge. It may be considered the best expression of Lutheran orthodoxy of the period. He is not to be confused with David Hollaz, his son, who preached at Günthersberg, and was the author of *Beschreibung der Wiedergeburt* (1737); *Anweisung zum Gebet* (1747); *Evangelische Gnadenordnung* (1751), and *Pilgerstrasse nach Zion* (1771).

HOLLEBEN, hôl′lâben, Theodor von (1838 —). A German diplomat. He was born in Stettin, and in 1872 left the Hussars for the diplomatic service. He was Minister to Argentina (1875-85), Envoy to Japan (1885-91), to Washington (1891-93); to Stuttgart (1893-97); and then again to Washington, where he received the rank of Ambassador. After the failure of the German effort to induce President Roosevelt to act as arbitrator in the Venezuelan dispute, von Holleben resigned because of failing health.

HOLLES, hōlz, Denzil, Lord (1599-1680). An English statesman, born at Haughton, Nottinghamshire. He was a member of Parliament for Saint Michael, Cornwall, in 1624, and five years afterwards was one of two members who forced the Speaker to keep his seat when he strove to obey Charles I. by adjourning the House before it could pass certain acts upon taxation and religion obnoxious to the King. Holles was fined and imprisoned in the Tower for nearly a year, but made his escape abroad, and returned to represent Dorchester in the Long Parliament (1640). Two years afterwards he was one of the famous five members whom King Charles tried unsuccessfully to arrest, and while the Civil War was in progress held Bristol for the Parliament, and raised a regiment of foot that made its mark at Edgehill and Brentford. He was most anxious to effect a reconciliation with the King, because, being a leader of the Presbyterian, as opposed to the Independent Party, he feared military even more than royal supremacy. When he proposed the disbandment of the army in 1647, its leaders accused him of high treason, and he was once again obliged to seek an asylum on the Continent, and remained in France until the close of the Protectorate. Though he worked for the restoration of the Stuarts after his return, he was ever watchful that Charles II. did not encroach upon the public liberties, dearer to him than the King who had made him a peer (1661), and in whose Privy Council he sat (1679), and he exercised his great influence toward the disbanding of the army lest the restored monarch should attempt to use it for his own purposes. Lord Holles was one of the commissioners of the Treaty of Breda (1667), and wrote a number of political pamphlets of little present interest.

HOL′LEY, Alexander Lyman (1832-82). An American metallurgist, born at Lakeville, Conn., where his father, Alexander H. Holley, later Governor of the State, had a cutlery factory, in which the boy became an adept as a machinist. He took a scientific course at Brown University (1850-53); entered the Corliss and Nightingale shops at Providence, R. I.; worked in the Jersey City locomotive-works; and in 1854 became editor and partner with Zerah Colburn of the *Railroad Advocate*. Four years later he and Colburn wrote *The Permanent Way and Coal-Burning Locomotive Boilers of European Railways*, which did much to reform American railroad management. He was an editor of the New York *Times* and of Webster's *Dictionary;* traveled in Europe in 1862, and wrote a *Treatise on Ordnance and Armor* (1864). In 1863 he went to England, purchased the Bessemer patents, and two years later started the Bessemer plant at Troy. He was closely connected with the building of steel-works at Harrisburg, North Chicago, Joliet, Pittsburg, Saint Louis, Cambria, Bethlehem, and Scranton, and made many improvements on the old Bessemer plant. He was a trustee of the Rensselaer Polytechnic Institute (1865-82), and in 1875 he became president of the Institute of Mining Engineers and a member of the Government board for testing structural materials.

HOLLEY, Myron (1779-1841). An American reformer and editor, born in Salisbury, Conn. A graduate of Williams College, he began the practice of law in 1802, but left it for a book-selling business in Canandaigua, N. Y., and was a leading promoter of the Erie Canal. Afterwards he was prominent in the anti-Masonic and the anti-slavery movements. He was editor first of the *Countryman* (1831-34), then of the Hartford *Free Elector*, and of the Rochester *Freeman*.

HOL′LIDAYSBURG. A borough and the county-seat of Blair County, Pa., six miles south of Altoona; on the Juniata River and on branches of the Pennsylvania Railroad (Map: Pennsylvania, C 3). It is the seat of the Hollidaysburg Female Seminary. Coal, iron ore, and limestone are found in the vicinity; and the borough has nail-factories, foundries, and machine-shops, rolling-mills, boiler-works, etc. Population, in 1890, 2975; in 1900, 2998.

HOL′LINS, Alfred (1865—). An English musician, born at Hull. He was blind from his birth, and at nine years of age entered the Wilberforce Institution for the Blind at York, where he remained three years, studying music under William Barnby. In 1878 he entered the Royal Normal College for the Blind, at Upper Norwood, making the piano his chief study, his teacher being Fritz Hartvigson. Through the kindness of the principal of the institution he secured organ lessons from E. J. Hopkins, who took a special interest in him, and who helped him considerably in the mastery of orchestration, which was later a conspicuous feature of his compositions. At the age of sixteen he had given recitals before the Courts of England and Germany, and was a special favorite with Queen Victoria and the Empress Frederick of Germany. In furtherance of his equipment as a pianist he studied piano with Von Bülow in Berlin, and in 1887 became a pupil at the Raff Conservatory, studying in addition under Max Schwartz. He visited America twice, in 1886 as a member of Dr. Campbell's party, and in 1888 as a concert organist. His most important engagement was as organist of United Free Saint George's Church, Edinburgh. His organ compositions are universally known, and are very popular in the United States. The following are among his better-known works: Two concert overtures (in C major and C minor); andante in D; grand *chœur* in G minor; two preludes; intermezzo in D flat; and a nocturne in B flat.

HOLLINS, George Nichols (1799-1878). An American naval officer. A native of Baltimore, Md., he was midshipman at the age of fifteen, and being aboard a frigate taken by the English, he was held a prisoner by them till the end of the War of 1812. Ten years later he had exchanged the naval for the merchant service, and by 1844 was captain of an armed vessel which he subsequently employed to enforce the rights of Americans living in Nicaragua, thereby causing international complications with Great Britain. This was in 1855. At the outbreak of the Civil War he sided with the Confederates and became a commodore in their navy, rendering important service, but at the peace he turned landsman and was court crier in Baltimore.

HOL′LISTER. A town and the county-seat of San Benito County, Cal., 94 miles southeast of San Francisco; on a branch of the Southern Pacific Railroad (Map: California, C 3). It is the centre of farming, fruit-growing, dairying, and stock-raising interests. The town has a public library. Population, in 1890, 1234; in 1900, 1315.

HOLLISTER, Gideon Hiram (1817-81). An American author, born in Washington, Conn. After graduating at Yale (1840), he studied and practiced law in Litchfield, with digressions to other towns in Connecticut, and a year in Haiti as United States consul (1868-69). In 1880 he was sent to Congress. His literary work consists of an historical novel, *Mount Hope* (1851); *History of Connecticut* (2 vols., 1854); *Thomas à Becket: A Tragedy, and Other Poems* (1866), and *Kinley Hollow* (1882), published posthumously.

HOLLMANN, hōl′män, Friedrich (1842—). A German admiral, born in Berlin. He entered the Russian Navy in 1857, served in the Asiatic expedition of 1859-62, commanded a gunboat in 1864, and, after service on schoolship and at the Kiel Naval Academy, fought at the battle of Grille in the Franco-Prussian War. His advance was rapid; in 1889 he arranged the trip of the German Emperor and Empress to Greece and Turkey; and in the following year he was made Secretary of State for the Navy, a post which he held until June, 1897, when he resigned because of his inability to pass the naval budget. He had been promoted to admiral in 1896.

HOL′LOWAY, Laura Carter (afterwards Mrs. Langford) (1848—). An American author, twice married, whose maiden name was Carter. She was born in Nashville, Tenn., and was educated at the Female Academy there. She was president of the Seidl Musical Society in Brooklyn and a collaborator with Anton Seidl himself in the musical work for the *Standard Dictionary*. She published *Ladies of the White House* (1870); *An Hour with Charlotte Brontë* (1883); *The Mothers of Great Men and Women* (1884); *Chinese Gordon* (1885); and *The Buddhist Diet Book* (1887).

HOLLOWAY COLLEGE. An institution founded in 1883, in Mount Lee, Egham, Surrey, England, by Thomas Holloway, for the purpose of supplying higher education to women, particularly of the middle class. The building is very handsome in the French Renaissance style, and was opened by Queen Victoria in 1886. Twelve trustees look after the management.

HOLLOW-WARE. There are two classes of iron goods so called, viz. cast-iron hollow-ware and wrought-iron hollow-ware. Both kinds include cooking and other vessels for domestic use, and comprise also some other articles, such as coffee-mills, which are molded and finished in a similar way. Wrought-iron hollow-ware is largely made by the process of stamping. (See Dies and Die-Sinking.) Hollow-ware is finished in three ways; some of it is enameled, some tinned, and some of it is left black, or untinned. See Enamel.

HOLLS, George Frederick William (1857-1903). An American lawyer. He was born at Zelienople, Pa., graduated at Columbia (1878) and at Columbia Law School (1880), and gained a large German-American practice in New York City. He was a Republican delegate-at-large to the State Constitutional Convention in 1894, and was commissioner on government of cities of the third class (1895). In 1898 he did much in Germany to better feeling toward the United States, and in the following year was appointed secretary and counsel of the American delegation to the Peace Conference at The Hague. In the treaty there concluded, Holls wrote the article *Special Mediation*. He wrote: *Franz Lieber* (1884, in German); *Sancta Sophia and Troitza*, a sketch of travel in Russia and the East (1888); *Compulsory Voting* (1891); and *The Peace Conference at The Hague and Its Bearings on International Law and Polity* (1900).

HOLLY (older *hollen*, from AS. *holen;* connected with Ir. *cuilenn*, Gael. *cuilioun*, Welsh *celyn*, holly, and also with OHG. *hulis*, *huls*, Ger. *Hülse*, holly, Skt. *śala*, staff), *Ilex*. A genus of trees and shrubs of the natural order Ilicineæ, chiefly natives of temperate climates; with evergreen, leathery, shining, and generally spinous leaves. The common holly (*Ilex Aquifolium*), the only European species, and a native also of some parts of Asia, is a well-known ornament of parks and shrubberies in Great Britain, where it sometimes attains a height of fifty feet upon suitably light soils. Numerous varieties of holly have been produced, or at least perpetuated, by cultivation, which exhibit great diversity in the leaves. The flowers of the holly are whitish, axillary, nearly umbellate; the fruit small, scarlet, rarely yellow or white. Medicinal properties are attributed to the leaves, berries, and roots. Bird-lime is made from the inner bark. The wood is almost as white as ivory, very hard and fine-grained, and is used by cabinet-makers, turners, musical-instrument makers, etc., and sometimes for wood-engraving. The holly is often planted for hedges, since it bears clipping well. The name holly is said to be derived from the use of the branches and berries to decorate churches at Christmas, from which the tree was called holy-tree. Numerous species of holly are found in North America, most of them in swampy situations; in South America, Nepal, Japan, and other parts of the world. Some of these have been introduced as ornamental trees and shrubs. Maté (q.v.), or Paraguay tea, is the leaf of a South American species of holly (*Ilex Paraguensis*). In the United States there are a dozen species of Ilex, the finest of which, American holly (*Ilex quercifolia*), is a small tree 20 to 40 feet tall, extensively used as a Christmas decoration, though the leaves are less glossy and the berries not so bright a red as the European species. *Ilex cassine* is a shrub which occurs from Virginia southward. Its leaves are used for tea, and it furnished the 'black drink' of the North Carolina Indians.

HOLLY (*Ilex Aquifolium*).

HOL'LYHOCK (ME. *holihoc*, holy hock,, from *holi*, AS. *hālig*, holy + *hoc*, AS. *hoc*, leaf), *Althæa rosea*. A plant of the natural order Malvaceæ, native of India and south of Europe, etc., and common in gardens through the world. It has a tall, straight, hairy, unbranched stem, 8 to 15 feet tall, heart-shaped, crenate, wrinkled, five to seven angled leaves, which diminish upward into bracts; and large axillary flowers, almost without stalks, which on the upper part of the stem form a spike; the petals are hairy at their bases. Its flowers vary much in color, and double and semi-double varieties are common. It is an ornamental autumnal flower, which continues till frost. It is propagated either by seed or cuttings.

HOLLYHOCK (*Althæa rosea*).

The plant is frequently attacked by a fungus, a rust, *Puccinia malvacearum*, which has greatly reduced its culture in many parts of the United States and Europe. Its presence may be first noticed in May or June by small yellow spots on the leaves and stems. Soon the leaves become dry and dead, as though scorched by fire. Any standard fungicide applied frequently from early spring until flowering time will keep the disease in check. Washing the leaves with a solution of two tablespoonfuls of potassium permanganate in a quart of water is a common remedy employed in Europe. The hollyhock is sometimes attacked by blight (*Colletotrichum malvarum*), and a leaf-spot disease (*Cercospora althæina*), both of which may be prevented by the use of some good fungicide (q.v.).

HOLLY SPRINGS. A city and the county-seat of Marshall County, Miss., 45 miles southeast of Memphis, Tenn., at the junction of the Illinois Central and the Kansas City, Memphis and Birmingham railroads (Map: Mississippi, G 1). It has a public library, Rust University for negroes (Methodist Episcopal), opened in 1868, a colored State Normal School, founded in 1870, the North Mississippi Presbyterian College for young ladies, the Holly Springs Normal Institute, and other educational institutions. The city is principally engaged in the cotton trade, and has a cotton compress and gin, a cottonseed-oil mill, stone-jug factories, etc. Holly Springs is governed under a charter of 1896, which provides for a mayor, elected biennially, and a city council. The water-works and electric-light plant are owned and operated by the municipality. In December, 1862, during the Civil War, General Grant established here a depot of supplies, protected by a small garrison under Col. R. C. Murphy, preparatory to moving forward against Vicksburg. On December 20th the Confederate General Van Dorn by a rapid movement captured the post, taking about 1500 prisoners, and destroyed supplies valued by Grant at $400,000. This, together with a raid by Forrest into Tennessee, forced Grant to abandon for a time his forward movement. Population, in 1890, 2246; in 1900, 2815.

HOLM, Saxe. The nom-de-plume signed to a series of short stories, first published in *Scribner's Monthly Magazine*, and then in a volume (New York, 1873; second series, 1878). They have been attributed to Mrs. H. M. F. Jackson (at the time of publication, Mrs. Helen Hunt).

HOL'MAN, Joseph George (1764-1817). An English actor and dramatist. Educated in London and at Oxford, he made his début, when twenty years of age, as Romeo at Covent Garden, and continued to present Shakespearean and other rôles there till the end of the eighteenth century. In 1806 he played in Dublin, then at the Haymarket, London. He went in 1812 to America, where he had the support of his daughter in performances at New York City and Philadelphia. He made two attempts at theatrical management in the United States, but was more successful as a writer of comedies and comic operas, such as: *Abroad and at Home* (1796); *Red Cross Knights* (1799); *Votary of Wealth* (1799); and *What a Blunder* (1800).

HOLMAN', Silas Whitcomb (1856-1900). An American physicist, born at Harvard, Mass. He graduated at the Massachusetts Institute of Technology in 1876, was appointed an instructor in that institution in 1881, assistant professor in 1882, associate professor in 1885, and professor in 1893. In 1897 ill health and failing eyesight compelled him to retire with the title of professor emeritus. He was particularly interested in the methods of laboratory instruction, and published investigations on *The Effect of Temperature on the Viscosity of Air* (1876), and on *The Viscosity of Gases;* and other works, including *Physical Laboratory Notes* (1885-95); *Computation Rules and Logarithms* (1896); and *Matter, Energy, Force, and Work* (1898).

HOLMAN, William Steele (1822-97). An American jurist and politician. He was born in Dearborn County, Ind., and was educated at Franklin College, became a lawyer, and held several judicial positions; was a member of the Indiana Constitutional Convention in 1850, and of the Indiana Legislature in 1851. With the exception of eight years he was a Democratic Representative in Congress from 1859 till his death, in 1897; and from his opposition to extravagant appropriations was known as 'the great objector' and 'the watch-dog of the Treasury.'

HOLMBOE, hôlm'bĕ, Kristoffer Andreas (1796-1882). A Norwegian Orientalist and numismatist, brother of Bernt Michael Holmboe (1795-1850), the mathematician. He was born at Vang; studied at Christiania, and made a specialty of Oriental languages, especially Persian, under De Sacy, in Paris (1821-22). In 1822 he became lektor in Oriental languages at Christiania, and in 1825 professor. Besides being a pioneer in philology he took an active interest in education. He founded (1834) the *Norske Universitets og Skole-Annaler.* His more important works are: *De Re Prisca Monetaria Norvegia* (1841); *Sanskrit og Oldnorsk* (1846); *Det Oldnorske Verbum* (1848); *Det Oldnorske Sprogs väsentligste Ordforraad, sammenlignet med Sanskrit* (1852); *Norsk og Keltisk* (1854); and the very valuable *Bibelsk Real-Ordbok* (1868).

HOLM'BY HOUSE. A mansion near Northampton, England, erected by Sir Christopher Hatton during the reign of Elizabeth, and later purchased by James I. It was here that Charles I. was imprisoned by the Parliamentary commissioners from the time he was surrendered by the Scots until removed to Newmarket by Cornet Joyce (February-June, 1647). Five years thereafter the house was dismantled. See Gardiner, *History of the Great Civil War*, vol. iii. (new ed., London, 1893).

HOLMES, hōmz, Abiel (1763-1837). An American Unitarian clergyman and historian, born at Woodstock, Conn. He graduated at Yale in 1783, and for a time was a tutor and a student of theology there. His first pastorate was at Midway, Ga., in a district settled largely by New Englanders. There he remained from 1785 till 1791, when he accepted a call to the First Congregational Church of Cambridge, Mass., where he continued during the next forty years. His first wife was a daughter of President Stiles, of Yale College; his second was the daughter of Oliver Wendell, and became the mother of Oliver Wendell Holmes (q.v.). His publications include: *A Life of President Stiles* (1798); *Annals of America* (2d ed. 1829), his best-known work, characterized by the minutest accuracy and still standard for the period covered; *Historical Sketch of the English Translation of the Bible* (1815); and a number of sermons, addresses, and memoirs.

HOLMÈS, ô'mĕs', Augusta Mary Anne (1847-1903). A French song composer, born in Paris of English-Irish parents. Her father was Captain Dalkeith Holmes, of the British Army, and her mother was a member of an old Hampshire (England) family. She studied under Lambert, Klosé, and César Franck, and although a brilliant pianist (in her childhood regarded as a prodigy), she attained distinction entirely through her compositions. In 1879 she won the third prize with her *Lutèce* in an open competition instituted by the city of Paris. Her other important compositions are a psalm, *In exitu* (1873); the symphony *Héro et Léandre* (1874); an *Andante pastoral* (1877); the symphonies *Les Argonautes* (1880) and *Irlande* (1885); and over a hundred songs, besides other orchestral works.

HOLMES, hōmz, George Frederick (1820-97). An American educator. He was born in British Guiana; was educated at Durham University, England; came to America in 1838, and taught in Virginia, South Carolina, and Georgia. He was for a time one of the editors of the *Southern Quarterly Review*, and in 1846 was president of the University of Mississippi. From 1847 to 1857 he was professor of history, political economy, and international law in William and Mary College. From that time until his death he was professor of history and literature in the University of Virginia. He prepared a series of text-books for the use of schools in the Southern States, in which the sentiments and selections were made with reference to the justification of slavery.

HOLMES, Mary Jane (c.1839—). An American novelist. Her maiden name was Hawes, and she was born in Brookfield, Mass., but moved at her marriage to Versailles, Ky., and afterwards Brockport, N. Y. She was at first a district school-teacher, and the didactic tendency is perceptible throughout her works, which were favorites of the young person of a past generation. Her first novel, *Tempest and Sunshine* (1854), was followed by a book almost every year, and the circulation of her books has exceeded two millions.

HOLMES, NATHANIEL (1815-1901). An American jurist and author, born in Peterboro, N. H. He graduated at Harvard, began legal practice in 1839 at Saint Louis, and was judge of the Missouri Supreme Court from 1865 to 1868. From that time until 1872 he was law professor at Harvard, but he retired altogether from public life in 1883. In *The Authorship of Shakespeare* (1866) he credits Francis Bacon with the dramas, and he published also *Realistic Idealism in Philosophy Itself* (2 vols., 1888), and an *Historical Address* (1890).

HOLMES, OLIVER WENDELL (1809-94). An American man of letters, born at Cambridge, Mass., August 29, 1809, son of the Rev. Abiel Holmes (q.v.). Holmes was brought up in the orthodox faith, was sent to Phillips Academy, Andover, Mass., for his preliminary education, and graduated from Harvard College in 1829. He at once entered the Law School of that institution, but, finding the law uncongenial, he gave it up for medicine. While a law student he wrote and published in the *Boston Advertiser,* in 1830, his well-known and stirring verses, "Old Ironsides," which were an effective and popular protest against the proposed breaking up of the famous frigate *Constitution.* After three years in the Harvard Medical School, Holmes, in 1833, sailed for Europe, where he studied two years, chiefly in Paris, and on his return began the practice of medicine in Boston in 1836. The same year witnessed the publication of his first volume of poems. In 1838 he was appointed to the professorship of anatomy at Dartmouth College, a post which he held for two years. Thenceforth he passed his life almost wholly in Boston, with which city his name became very intimately associated. On June 15, 1840, he married Miss Amelia Lee Jackson of Boston. His only important contribution to medical science was made in 1843, when he published his essay on the *Contagiousness of Puerperal Fever,* though he wrote numerous other scientific papers. From 1847 to 1882 he was Parkman professor of anatomy and physiology in the Harvard Medical School. He was, however, not really eminent in his profession. His literary gift was marked, and he was less renowned in Boston as a practitioner than as a writer of very facile, witty verse, collections of which appeared in 1836, 1846, 1849, 1850, and later.

Until 1857, however, his reputation was almost wholly local. The establishment in that year of the *Atlantic Monthly,* under the editorship of Lowell, brought him a national and almost worldwide vogue through the serial publication in that magazine of the *Autocrat of the Breakfast Table,* which appeared in book form in 1858. These delightfully egotistical talks, full of brilliant wit and buoyant seriousness, essentially of New England and Boston, had had their origin in two forgotten essays by Holmes in the *New England Magazine* in 1833. The success of *The Autocrat* was remarkable, and Holmes has been likened to almost every famous essayist from Montaigne to Lamb. Among orthodox Calvinists the sketches met with disfavor, since the ideas and the manner were those of an essential rationalist. They were followed in the next year by a series scarcely less delightful, *The Professor at the Breakfast Table* (pub. 1860 in book form), and after a lapse of more than a decade, in 1871-72, by the third and last volume of the series, *The Poet at the Breakfast Table. The Autocrat,* however, is the best, most original, and most popular of the works of Holmes, who is often called 'The Autocrat.'

In 1861 Holmes published his first novel, *Elsie Venner.* Though rather formless and uneven in quality, and inartistic in method, it is interesting, and full of power. More commonplace in idea than *Elsie Venner,*but equally interesting in its delineation, often rather contemptuous, of New England character, was *The Guardian Angel* (1867). In the interval between these two novels appeared *Songs in Many Keys* (1861) and *Humorous Poems* (1865), and a volume of prose, *Soundings from the Atlantic* (1863). His remaining literary work contained nothing very new or striking. The chief titles are: *Mechanism in Thought and Morals* (1871); *Songs of Many Seasons* (1874); *John Lothrop Motley* (1878), a memoir; *The School-Boy* (1878); *The Iron Gate, and Other Poems* (1880); *Pages from an Old Volume of Life* (1883); *Medical Essays* (1883); *Ralph Waldo Emerson* (1884), a life; *A Mortal Antipathy* (1885), his last novel, inferior to the two former; *The New Portfolio* (1885-86) in the *Atlantic; Our Hundred Days in Europe* (1887), an account of a voyage taken with his wife and daughter; *Before the Curfew, and Other Poems* (1888); and *Over the Tea-Cups* (1890), in the vein of *The Autocrat.* His death occurred in his eighty-sixth year, in Boston, October 7, 1894.

Dr. Holmes was slight in stature and fastidious as to his personal appearance. In temper he was humane and kindly, particularly gracious to his numerous correspondents when confident of their sincerity, and genial in all his writing. His social accomplishments were unusual; he is said to have been the best talker in Boston. His style, at its best, is the style of spoken discourse—light, intimate, and winning, but not flippant. His verse, which is almost wholly of an occasional character, such as poems read at reunions of his college class or scattered throughout the pages of *The Autocrat,* is, like that prose work, sparkling with wit, or a graceful compound of gravity and humor. He is a prince among writers of *vers de société.* Among the best known of his poems are "Old Ironsides," "The Chambered Nautilus," "The Last Leaf," "Dorothy Q.," "The Voiceless," "The Deacon's Masterpiece; or, the Wonderful One-Hoss Shay," a satire against the doctrines of Jonathan Edwards.

BIBLIOGRAPHY. Consult Morse, *Life and Letters of Holmes,* vols. xiv. and xv. of the *Collected Works.* Sketches are to be found in Higginson, *Old Cambridge* (New York, 1900), and Howells, *Literary Friends and Acquaintance* (New York, 1899). The literary historians, as Stedman, Richardson, and Wendell, discuss at some length his general position in the history of American letters. The standard edition of his works is the Riverside, in fifteen volumes (Boston, 1892).

HOLMES, Oliver Wendell, Jr. (1841—). An American jurist, son of Dr. O. W. Holmes. He was born in Boston; was educated at Harvard; served in the Civil War, and was three times wounded—at Ball's Bluff, at Antietam, and at Fredericksburg. He practiced law in Boston; edited the *American Law Review* (1870-73); became professor of law at Harvard in 1882; and in the same year entered the Massachusetts Supreme Court, of which he became Chief Justice in 1899. In 1902 he was named to succeed Justice Gray in the United States Supreme Court. Holmes edited the twelfth edition of Kent's *Commentaries* and published his own Lowell Institute lectures, *The Common Law* (1881).

HOLMES, Theophilus Hunter (1804-80). An American soldier, prominent on the Confederate side in the Civil War. He was born in Sampson County, N. C., graduated at West Point in 1829, served in the Florida War and the War with Mexico, and at the outbreak of the Civil War was acting as superintendent of the general recuiting service, with the rank of major. In April, 1861, he resigned his commission in the United States Army, and for a time was engaged in organizing the State troops of North Carolina. He became a brigadier-general in the Confederate service soon after the secession of his State, commanded the Confederates in the engagement at Aquia Creek, was promoted to be major-general, and from September, 1862, to March, 1863, was in command of the Trans-Mississippi Department, attaining the rank of lieutenant-general. On July 3, 1863, he made an unsuccessful attack on Helena, Ark.

HOLMES, William Henry (1846—). An American geologist. He was born near Cadiz, Ohio, and after graduating at the McNeely Normal College (1870), was assistant on the United States Geological Survey (1872-80). During that period he accompanied Dr. F. V. Hayden's explorations in the Rocky Mountain region, and superintended the survey of the San Juan territory until the reorganization of the survey (1880) when he was appointed geologist in charge of the department of illustrations; had charge of the archæological explorations of the Bureau of Ethnology in 1889-93; in 1894-98 was professor of archæologic geology at the University of Chicago; and in 1898 was made curator of the United States National Museum. He edited geological publications, including Hayden's *Atlas of Colorado* and the eleventh and twelfth reports of the Geological Survey, and published reports on the cliff ruins of the San Juan country, and on aboriginal American art and archæology. He is a fellow of the American Association for the Advancement of Science.

HOLMGREN, hŏlm'grĕn, Alarik Frithiof (1831-97). A Swedish physiologist, born in Vestra Ny (East Gotland), and educated at the University of Upsala, at the University of Berlin under DuBois-Reymond and Helmholtz, and under Brücke and Ludwig in Vienna. In 1864 he became professor of physiology at Upsala, the first chair in that subject in Sweden, and soon afterwards founded a physiological laboratory. His medical studies were mostly in the field of ophthalmology, and he was an authority on color-blindness; his work on this subject, *Om färgblindheten i dess förhållende till järnvägstrafiken och sjöväsenct* (1877) has been translated into many languages. Holmgren was a firm believer in the hygienic value of Swedish gymnastics. He edited the *Skandinavisches Archiv für Physiologie* (1889 sqq.).—His wife, Ann Margreta Tersmeden (1850—), under the pseudonym Märta Bolle, wrote the novels *Fru Stråle* (1894) and *När Kiadar Alf suckar* (1896).—His brother. August Emil Holmgren (1829—), is a naturalist of much ability. He wrote: *Ichneumonologia Suecica* (1864); *Handbok i Zoologi* (1865-71); *Om Smafoglarne* (1869); and *Om skadeinseketer iniomhus* (1879), besides other works on entomology and ornithology.

HOL'OCEPH'ALI (Neo-Lat. nom. pl., from Gk. *ὅλος*, *holos*, entire + *κεφαλή*, *kephalē*, head). A subclass of cartilaginous fishes, including the single living family Chimæridæ. The number of living species is small, but in the remote past they were a dominant group, numerous in species. See Chimæra.

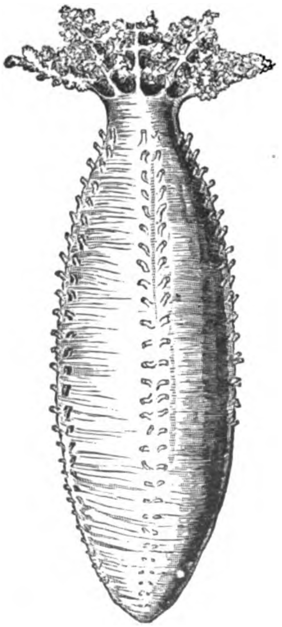
HOLOFERNES, hŏl'ŏ-fĕr'nêz, or **HOLOPHERNES.** (1) The stock pedant in Italian comedy. (2) The tutor of Gargantua, in Rabelais's *Gargantua and Pantagruel*, who teaches his pupils to say the alphabet backward. (3) A pedantic schoolmaster in Shakespeare's *Love's Labour's Lost*, said to have been meant for John Florio, author of a dictionary.

HOL'OGRAPH (Lat. *holographus*, from Gk. ὁλόγραφος, written entirely by the author's hand, from ὅλος, *holos*, entire + γράφειν, *graphein*, to write). A deed or writing wholly by the hand of the maker or author. In those countries which derive their legal systems mainly from the civil, or Roman, law, a holographic writing is deemed to prove itself; that is, proof of the handwriting of the person whose instrument it purports to be is in itself sufficient to authenticate the document, without formal attestation by subscribing witnesses. notarial seals, and the like. This is true of Scotland, Quebec, and Louisiana, as well as of most Continental States. In the common-law system, however, of England and America, no distinction of superior validity attaches to holographic writings, and they require the same formal attestation and the same proof of validity as other writings. See Evidence; Handwriting, and the authorities there cited.

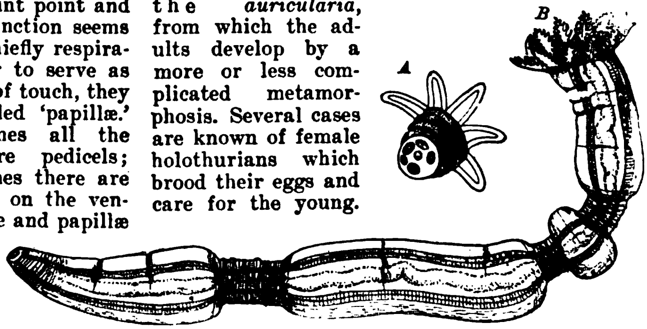
HOLOPTYCHIUS, hŏl'ŏp-tĭk'ĭ-ŭs (Neo-Lat., from Gk. ὅλος, *holos*, entire + πτυχή, *ptychē*, πτύξ, *ptyx*, fold). A genus of fossil ganoid fish of the order Crossopterygii, remains of which are found commonly in the Catskill sandstones of North America and in the Old Red Sandstone of the British Devonian system. Some of the species were thirty inches long, with rounded tapering bodies, and heterocercal tails. There are two dorsal fins, a pair of long, stout, pointed pectoral fins, and short pelvic and anal fins. The body was covered with large, rounded (cycloid) scales, the surfaces of which are marked by prominent ridges of ganoine, a structureless enamel. These scales, of gray or bluish-white color and one to three inches in diameter, are very abundant in some parts of the Catskill formation in New York and Pennsylvania. See Catskill Group; Devonian System; Ganoidei; Fossil.

HOLOSTEI, hŏl-ŏs′tē-ī (Neo-Lat. nom. pl., from Gk. ὅλος, *holos*, entire + ὀστέον, *osteon*, bone). A group of bony ganoids, embracing the garpikes and bowfins (q.v.).

HOL′OTHU′RIAN (from Lat. *holothurium*, Gk. ὁλοθούριον, water-polyp; probably from ὅλος, *holos*, entire + θούριος, *thourios*, θοῦρος, *thouros*, impetuous). An echinoderm of the class Holothuroidea, easily recognized by the soft body, generally worm-like form, and circle of tentacles about the mouth. The madreporic plate is internal. 'Sea-cucumber,' 'sea-squirt,' and 'sea-slug' are some of the popular names of these animals, whose dried bodies form the Oriental 'trepang' (q.v.). The class have not the covering of calcareous plates characteristic of the more typical Echinodermata, but a tough leathery muscular integument, in some genera strengthened by minute or rather large calcareous plates or hooks, very irritable, and capable of great distention and contraction. Some of them are almost globose, some truly worm-like; but the same individual is often capable of extending itself to several times the length which it has in a state of repose. In locomotion the body is extended and contracted in the annelids, and in the apodous forms this is the only means of locomotion, except such aid as is given by the tentacles. In the pedate forms the principal organs of locomotion, as in starfishes and sea-urchins, are the ambulacral feet, of which there are sometimes five double rows, while sometimes they are distributed over the whole surface of the body; but some of the species have the feet developed only on the ventral side, and the body then presents an upper and an under surface. When the feet are furnished with suckers and are very extensible they are called 'pedicels,' but when they end in a blunt point and their function seems to be chiefly respiratory, or to serve as organs of touch, they are called 'papillæ.' Sometimes all the feet are pedicels; sometimes there are pedicels on the ventral side and papillæ on the dorsal; rarely all the feet are papillæ. In two families the feet are completely wanting.


THE COMMON NORTH ATLANTIC HOLOTHURIAN.
(*Pentacta frondosa.*)

The radiate structure is apparent at the mouth, which is surrounded with tentacles, in number frequently a multiple of five, exhibiting considerable variety of form, and capable of being more or less retracted. These tentacles vary in number from 8 to 30, but 10, 12, 15, and 20 are the usual numbers. They are very rarely short, simple, and unbranched; generally they are provided with branches which may be arranged along the sides, clustered at the top, or irregularly scattered. The tentacles are very sensitive and are the most important sense-organs of the animal; upon them are occasionally found special sense-cups, supposed to be olfactory, or there may be at the base pigment eyes or positional organs. The nervous system is perfectly radiate in structure and very simple in organization. The mouth opens into an alimentary canal, usually much longer than the body, and therefore more or less looped or coiled. An œsophagus, stomach, intestine, and cloaca can usually be distinguished. Arising from the cloaca, there are often two irregularly branched organs, known as the 'respiratory trees.' These are hollow, very thin-walled, and capable of containing a great deal of water, which they receive through the anus. They are excretory, and perhaps respiratory in function. In many species there arise from the wall of the cloaca, and extend into the body-cavity of the animal, numerous glandular tubules, known as Cuvier's organs. These can be ejected from the anus as long, sticky threads, and thus seem to be protective. The blood system is well developed in most holothurians, especially along the intestine. In those forms which have a respiratory tree one branch of it is often closely bound up with a network of blood-vessels, arising from the principal vessel on the intestine. The sexes are generally separate, hermaphrodite forms being quite unusual; but there is no external difference between male and female, save in a very few forms. The eggs are generally thrown out into the water, where they are fertilized, but several viviparous forms are known, in which the eggs fall into the body-cavity of the mother and the young develop there. In such cases the development is direct, but in species whose eggs develop in the water the young assume a peculiar larval form, known as the *auricularia*, from which the adults develop by a more or less complicated metamorphosis. Several cases are known of female holothurians which brood their eggs and care for the young.



SYNAPTA.
a, free-swimming young; *b*, adult synapta.

The holothurians are capable of the most extraordinary regeneration of parts, even of the most important organs. In direct relation with this is their curious and noteworthy habit of evisceration. Many species when alarmed or irritated expel from the anal opening (or less commonly the mouth) the viscera, either wholly or in part. They thus lose their entire digestive, reproductive, respiratory, and excretory systems and a large part of the blood system; but if not disturbed further, they will, in the course of a few weeks, replace all they lost with an entirely new set.

Holothurians are found in all seas, but particularly abound in the West Indies and between Asia and Australia. The largest American species is *Holothuria Floridana*, which abounds just below low-water mark on the Florida reefs. Another large one, *Cucumaria frondosa*, inhabiting the North Atlantic, and probably circumpolar, is about a foot in length, and is yellowish-brown. Many of the tropical species exhibit attractive colors, and are among the creatures which make the bottom of the sea, particularly among coral reefs and islands, extraordinarily interesting.

The holothurians (Holothuroidea) are classified in two orders according to the point of origin of the tentacles. In the *Actinopoda* they arise from the radial vessels of the water-vascular system, while in the *Paractinopoda* they arise from the circumoval ring. The Actinopoda include more than five-sixths of the species, and are grouped in five very distinct families. Of these, the Elasipoda are the most remarkable. They are all deep-sea forms and occur in all parts of the world. Many of them assume the most grotesque shapes, and some reach a large size. The Paractinopoda are all footless forms, of a single family. The best-known genus is Synapta, containing more than fifty species found in all parts of the world. About six hundred species of holothurians are known, varying in size from those half an inch long up to certain tropical species two or even three feet in length. The colors vary from white, or almost transparent, to jet-black, but as a rule the colors are more or less in correspondence with the bottom on which the animal lives. They chiefly feed on Foraminifera. Their movements are generally very sluggish, and they seem to have few enemies. All are harmless, but the only ones of any use to man are the larger forms, from which bêche-de-mer, or trepang, a great delicacy with the Chinese, is prepared.

Consult: Ludwig, "Die Seewalzen," in Bronn, *Klassen und Ordnungen des Tierreichs: Echinodermen*, vol. i. (Berlin, 1889-92), the standard work on holothurians; Lampert, *Die Seewalzen* (Wiesbaden, 1885); the best work in English is Theél, "Report on the Holothuroidea," in *Challenger Reports: Zoölogy*, vol iv., part 13, and vol. xiv., part 39 (London, 1882 and 1886).

HOL'OTHUROI'DEA. A class of echinoderms. See Echinodermata and Holothurian.

HOLST, hōlst, Hans Peter (1811-93). A Danish poet and novelist, born at Copenhagen. From 1875 until his death he was dramaturgist for the Royal Theatre, Copenhagen. His first work to attract attention was a memorial poem on Frederick VI. (1839). This was followed by *Ude og Hjemme*, prose and verse (1843), and *Den lille Hornblæser* (1849) a collection of patriotic poems. He also wrote a number of plays, vaudevilles and novels, and translated *Much Ado About Nothing* (1880).

HOLST, Hermann Eduard von (1841-1904). A German-American historian and educator, born at Fellin, in Livonia, of German parentage. He studied at Dorpat from 1860 to 1863, and at Heidelberg from 1863 to 1865, and became a tutor at Saint Petersburg in 1866; but was excluded from the Russian dominions in the following year for publishing a pamphlet of which the Russian Government disapproved, and emigrated to America. Settling in New York, he taught modern languages for a time in a small private school, made a number of political speeches in the Presidential campaign of 1868, and was an assistant editor of Schem's *Deutsch-Amerikanisches Konversations-Lexikon.* He then returned to Germany, was professor of history in the University of Strassburg from 1872 to 1874, and in the University of Freiburg from 1874 to 1892, visited America in 1878-79 and in 1884, served for a number of years in the Baden Diet, for the last two sessions as vice-president, and in 1892 became head of the department of history in the newly founded University of Chicago. In 1900 ill health compelled his retirement, and he returned to his home in Freiburg. Von Holst's works are almost altogether on American topics. His *Verfassung und Demokratie der Vereinigten Staaten von Amerika* (5 vols., 1873-91), English translation by Lalor and Mason, *The Constitutional and Political History of the United States* (8 vols., 1876-92), is his best-known work, and contains a remarkably able presentation of the Federalist and anti-slavery view of American political history. Among his other publications are: *Das Staatsrecht der Vereinigten Staaten von Amerika* (1885), English translation, *The Constitutional Law of the United States of America* (1887); *John C. Calhoun*, in the "American Statesmen Series" (1882); *John Brown* (1888); and *The French Revolution Tested by Mirabeau's Career* (1894). Consult Hart, "Hermann von Holst," in the *Political Science Quarterly*, vol. v. (New York, 1890).

HOLSTEIN, hōl'stīn. Formerly a duchy belonging to Denmark, and at the same time a member of the Holy Roman Empire and of the Germanic Confederation (Map: Prussia, C 1). It was annexed in 1866 to Prussia, and now forms the southern part of the Province of Schleswig-Holstein (q.v.).

HOLSTEIN, or Holstein-Friesian. A breed of dairy cattle. See Cattle.

HOLSTEIN, Franz von (1826-78). A German composer, born at Brunswick. He entered a military school, and became an officer in the German Army, but at the same time studied music with Richter. In 1853 he resigned from the army and became one of Hauptmann's pupils at the Leipzig Conservatory. After traveling extensively he settled in Leipzig as a composer. His operas, of which he wrote both words and music, include: *Der Haideschacht* (1868); *Der Erbe von Morley* (1872); and *Die Hochländer* (1876). He also composed considerable vocal and instrumental music.

HOLSTEIN-GOTTORP, gŏt'tŏrp. See Oldenburg, House of.

HOL'STON RIVER. One of the two rivers, the Clinch being the other, which unite at Kingston, Roane Co., Tenn., to form the Tennessee River (Map: Tennessee, H 4). The Holston itself is formed by two forks rising in the Alleghanies in southwestern Virginia and uniting at Kingsport in Sullivan County, Tenn. With the north fork it is over 300 miles long, and is navigable to Knoxville at all seasons, and in winter to Kingston.

HOLT, Sir John (1642-1710). An English jurist. After receiving his education at Oxford, he was called to the bar, 1663, from Gray's Inn, to which he had been admitted when only ten years of age. He soon displayed a decided talent for law, and became an able advocate, well versed in the constitutional law of England. In 1685-86 he was Recorder of London, and about this time was appointed Sergeant-at-Law and King's Sergeant. Afterwards he fell into disfavor with King James II., but the ability which he displayed in the Convention Parliament raised him so high in the estimation of the Prince of Orange, that, upon the accession of the latter to the English throne, Holt was made Lord Chief Justice of the King's Bench. As a judge he was noted for the fairness and even kindness with which he treated accused persons, and for his opposition to prosecutions for witchcraft. He was also opposed to standing armies and to the use of military power for the preservation of domestic peace. Consult: *Report of All the Cases Determined by Sir John Holt, Kt. from 1688 to 1710*, etc. (in the Savoy, 1738); *Report of Cases Argued*, etc., *in B[anco] R[eginæ] in the Time of Queen Anne* (ib., 1737); Foss, *Judges of England: with Sketches of Their Lives*, etc. (London, 1848-64); Burnet, *History of His Own Time* (6 vols., London, 1838).

HOLT, JOSEPH (1807-94). An American jurist, born in Breckinridge County, Ky., and educated at Saint Joseph's College and Centre College in the same State. He studied law; practiced in Elizabethtown, then in Louisville; lived for a time after 1835 in Mississippi, where he contested several suits with Sergeant S. Prentiss, among them the case as to the ownership of some public land, claimed by the heirs of Newit Vick, for whom Prentiss was counsel. In the same year (1835) he attracted attention as politician and orator by his defense of R. M. Johnson in the Democratic National Convention. He was a strong supporter of Buchanan in 1856, and was appointed by him Commissioner of Patents in the following year. In 1859 he became Postmaster-General, and in 1860 succeeded Floyd as Secretary of War. A Douglas Democrat before the war, he heartily supported the Union, and in 1862 became Judge-Advocate, and two years later Judge Advocate-General. As head of the department of military justice he conducted the trial of Fitz John Porter and that of Lincoln's assassins. He was brevetted major-general in 1865 and retired ten years later.

HOLTEI, hŏl'tī, KARL VON (1798-1880). A German poet, dramatist, and novelist, born in Breslau, where at the age of twenty-one he went on the stage. In 1821 he married an actress, Luise Rogée, and after acting as secretary and dramaturgist to the Breslau Theatre for two years went to Berlin with his wife, who had been engaged at the Court Theatre there, and wrote the very successful plays, *Die Wiener in Berlin* and *Die Berliner in Wien*. His wife died in 1825, and he soon married Julie Holzbecher (1809-39), a clever comedienne. In 1833 he returned to the stage and toured with his wife, writing for this purpose *Lorbeerbaum und Bettelstab* and *Shakespeare in der Heimat* (1840). He died at Breslau, in the cloister of the Brothers of Charity. The best of his productions is his *Schlesische Gedichte* (20th ed. 1893), lyrics in the Silesian dialect. Holtei's collected plays are contained in the *Theater* (1867). Besides his plays and lyrics, Holtei wrote many novels, among which mention should be made of *Die Vagabunden* (8th ed. 1894); *Christian Lammfell* (4th ed. 1878); *Noblesse oblige* (2d ed. 1862), and others collected in *Erzählende Schriften* (1861-66); and sketches and criticisms. Consult Storch, *Karl von Holtei* (Waldenburg, 1898).

HOL'TON. A city and the county-seat of Jackson County, Kan., 80 miles northwest of Kansas City, Mo., on the Chicago, Rock Island and Pacific, the Union Pacific, and the Missouri Pacific railroads (Map: Kansas, G 2). It is the commercial centre for a stock-raising and farming section, the chief crops of which are corn, wheat, and hay. Campbell University (Baptist) was established here in 1882. Settled in 1859, Holton was incorporated in 1870. The government is administered by a mayor, elected every two years, and a common council. Population, in 1890, 2727; in 1900, 3082.

HOLTON, LUTHER HAMILTON (1817-80). A Canadian statesman, born in South Leeds, Ontario. He was a prominent merchant and city councilor of Montreal before becoming its representative in Parliament (1854-57). He was member for Chateaugay (1863-80), and held different positions in the Government. He was leader of the opposition in the Quebec local House, president of the Montreal Reform Association, a governor of McGill University, and for five years director of the Grand Trunk Railway.

HÖLTY, hĕl'tē, LUDWIG HEINRICH CHRISTOPH (1748-76). A popular German poet, born at Mariensee, the son of a country parson. He studied theology at Göttingen (1769), fell in there with Bürger, Voss, and the Stolbergs, and assisted in founding the patriotic poetic league of the Hainbund. He was naturally sentimental, and dwelt, though not morbidly, on death, nature, and solitude, showing the influence of Rousseau, and especially of the *Night Thoughts* of Young. Occasionally there is also a joyous or even a playful strain, but it is with harmonious melancholy that he is associated in the popular mind. A few of his poems are known wherever German is sung. Hölty's *Works* were collected in 1789. There is a life by Ruete (Guben, 1883), and biographies in the critical editions by Voss (Hamburg, 1835), Voigt (Hanover, 1858), and Halm (Leipzig, 1870).

HOLTZ, hōlts, WILHELM (1836—). A German physicist. He was born October 15, 1836, at Saatel, near Barth, in Pomerania, and studied physics and other sciences at Berlin, Dijon, and Edinburgh. He invented the electrical machine which bears his name (see ELECTRICAL MACHINE) in 1865, and engaged in many researches, particularly in electricity, but his health forced him to give up scientific investigations for a number of years. In 1877 he became assistant in the physical laboratory of Greifswald, where in 1881 he was made privat-docent, and three years later professor. He is the author of many papers on electricity published in the scientific journals, and of two volumes on lightning protection, *Ueber Theorie, Anlage und Prüfung der Blitzableiter* (1878), and *Ueber die Zunahme der Blitzgefahr und ihre vermuthlichen Ursachen* (1880).

HOLTZENDORFF, hōlts'en-dôrf, FRANZ VON (1829-89). A German jurist. He was born in Vietmannsdorf, Prussia; studied law at Berlin, Heidelberg, and Bonn; became professor of jurisprudence at Berlin in 1860, and held the same professorship at Munich from 1873 until his death. He strove especially to correct the criminal law, to abolish the death penalty, and to improve the condition of penal institutions. He was interested and active in the Protestant Union, in the Berlin People's Kitchens, and in the reform of female labor. Among his works are: *Französische Rechtszustände* (1859); *Die Reform der Staatsanwaltschaft in Deutschland* (1864); *Die Prinzipien der Politik* (2d ed. 1879); *Wesen und Wert der öffentlichen Meinung* (2d ed. 1880); and *Das Verbrechen des Mordes und die Todesstrafe* (1874). He edited: *Allgemeine deutsche Strafrechtszeitung* (1861-74); the *Encyklopädie der Rechtswissenschaft* (1880-90); a series of manuals on German law (1871-89); and with Virchow, the *Sammlung gemeinverständlicher wissenschaftlicher Vorträge* (1866 et seq.). Consult Stoerk, *Franz von Holtzendorff* (Hamburg, 1889).

HOLTZ (hôlts) **MACHINE.** See Electrical Machines.

HOLTZMANN, hôlts′mân, Adolf (1810-70). A German philologist, born at Karlsruhe. He studied theology at Berlin and was for a short time vicar at Kandern. In 1832 he renewed his studies at Munich and later at Paris, and made a specialty of old Germanic dialects and Sanskrit. In 1852 he was made professor of German and Sanskrit at Heidelberg, where he died. His works are: In Indian philology: *Ueber den griechischen Ursprung des indischen Tierkreises* (1841), and the translations *Ramajana* (last edition, 1843), *Indische Sagen* (1845-47); in Germanics: *Kelten und Germanen* (1855), an attempt to identify the two peoples; *Untersuchungen über das Nibelungenlied* (1854), and *Das Nibelungenlied* (1857), both attacking Lachmann's theory of the composite authorship of the poem and renewing the question; the much more important grammatical works, the edition of Isidorus (1836), *Ueber den Umlaut* (1843); *Ueber den Ablaut* (1844); *Altdeutsche Grammatik* (uncompleted, 1870-75); and the posthumous works, *Germanische Altertümer mit Text, Uebersetzung und Erklärung von Tacitus Germania* (1873), and *Deutsche Mythologie* (1874).

HOLUB, hó′lụp, Emil (1847-1902). An African explorer, born at Holitz in Bohemia. He studied medicine and natural science at the University of Prague, and then, in 1872, went to South Africa. He lived for a time in the diamond-fields, but early in 1873 made a journey through the southern Bantu countries, and in the fall a second to the Transvaal and the lands to the north. In 1875 he succeeded in reaching the Zambezi and the Victoria Falls, and brought back with him a rich natural science and ethnological collection, which he divided among various European institutions. In 1883, accompanied by his wife, he started from Cape Town with the intention of traversing the entire length of the African continent to Egypt. He had accomplished scarcely one-third of the journey, however, when he was attacked by hostile tribesmen on the Kafue, a northern tributary of the Zambezi, and only after a desperate struggle was he able to win his way back to civilization. Fortunately, he was able to save the large collection which he had gathered, and this, after it had been exhibited in Vienna and Prague, he divided among a number of museums. His publications include: *The Victoria Falls* (1879); *Sieben Jahre in Südafrika* (1880-81), translated by Ellen E. Frewer as *Seven Years in South Africa* (2d ed. 1881); and *Von Kapstadt ins Land der Maschukulumbe* (1888-90).

HOLY ALLIANCE. A league formed after the fall of Napoleon, at the instance of Alexander I. of Russia, by the sovereigns of Russia, Austria, and Prussia, nominally to regulate the relations of the States of Christendom by the principles of Christian charity. As it formed itself in the mind of Alexander it was the scheme of a pietistic idealist, but it was utilized by Metternich as an instrument of his reactionary policy. The document was drawn up by Alexander, and was signed by the three rulers at Paris in September, 1815. The Russian Emperor at that period was greatly under the influence of the mystical philosophy then current, and especially of its exponent, Madame Krüdener (q.v.), to whom was perhaps due his dream of a community of Christian States under their legitimate sovereigns, which was the underlying thought of the Alliance. In addition to the original signatories, Naples, Sardinia, France, and Spain acceded to the treaty, and it received the commendation, though not the signature, of the Prince Regent of Great Britain. It was formally made public in the *Frankfort Journal*, February 2, 1816. Metternich, who privately sneered at the treaty, used it as the basis for the conferences of Troppau and Laybach, and the congresses of Karlsbad and Verona, which were intended to unite the powers in support of absolutism everywhere. It was in the name of the Holy Alliance that Austria, in 1821, crushed the revolutions in Naples and Piedmont, and that France, in 1823, restored absolutism in Spain. Apart from this use of it, as one writer has said, "no one of the princes who adhered to the Holy Alliance, with the single exception of Alexander himself, ever took it seriously." Meaningless in itself, it soon ceased to have any importance.

The text of the covenant is as follows:

In the name of the Most Holy and Indivisible Trinity: Holy Alliance of Sovereigns of Austria, Prussia, and Russia. Their Majesties the Emperor of Austria, the King of Prussia, and the Emperor of Russia, having . . . acquired the intimate conviction of the necessity of settling the steps to be observed by the Powers, in their reciprocal relations, upon the sublime truths which the Holy Religion of Our Saviour teaches: They solemnly declare that the present Act has no other object than to publish, in the face of the whole world, their fixed resolution, both in the administration of their respective States, and in their political relations with every other government, to take for their sole guide the precepts of that Holy Religion, namely the precepts of Justice, Christian Charity, and Peace. . . . *Art. I.* . . . The three contracting Monarchs will remain united by the bonds of a true and indissoluble fraternity, and, considering each other as fellow countrymen, they will, on all occasions and in all places, lend each other aid and assistance; and, regarding themselves toward their subjects and armies as fathers of families, they will lead them, in the same spirit of fraternity with which they are animated, to protect Religion, Peace, and Justice. *Art. II.* In consequence, the sole principle of action, whether between the said Governments or between their Subjects, shall be that of doing each other reciprocal service, and . . . to consider themselves all as members of one and the same

Christian nation; the three allied Princes looking on themselves as merely delegated by Providence to govern three branches of the One family, namely, Austria, Prussia, and Russia, thus confessing that the Christian world, of which they and their people form a part, has in reality no other Sovereign than Him to whom alone power really belongs. . . . *Art. III.* All the Powers who shall choose solemnly to avow the sacred principles which have dictated the present Act . . . will be received with equal ardor and affection into this Holy Alliance. Done in triplicate and signed at Paris, the year of grace 1815, 14/26th September.

Perhaps the most noteworthy development from the Holy Alliance came from the attempt to extend its operation to the New World by the coercion of Spain's revolted colonies. George Canning (q.v.), on behalf of England, opposed this at the Congress of Verona, and the threatened invasion of American autonomy, together with the proposed colonization of the Pacific coast of North America by Russia, the leader in the Alliance, brought from the Government of the United States the famous declaration of American policy known as the Monroe Doctrine (q.v.). For accounts of the Holy Alliance and its bearing upon contemporaneous history, consult the histories of the time and the biographies of leading persons connected with it.

HOLY CITY. The common designation among different peoples and religious sects for the city regarded as the chief place of their religion. The term is most often understood as applying to Rome, but has been used also of Jerusalem, Allahabad, Benares, Mecca, Medina, Moscow, Kiev, and Cuzco.

HOLY COAT. A relic preserved with the greatest reverence in the Cathedral of Treves (q.v.). It is alleged to be the seamless robe or upper garment of Jesus Christ (John xix. 23), and to have been discovered in the fourth century by the Empress Helena, in her memorable visit to Palestine (see Helena, Saint) and by her deposited at Treves. The earliest definite documentary evidence, supported, however, by still earlier incidental testimony, dates from the eleventh century. The holy coat of Treves was solemnly exhibited to the public gaze in 1196, and again in 1512, when Luther wrote against it and Leo X. appointed it to be exhibited every seven years. The Reformation and wars prevented the regular observance of this religious festival; but it was celebrated in 1810, and was attended by a concourse of no fewer than 227,000 persons, and in 1844 and 1891 by still greater crowds, while miraculous cures were confidently asserted to be performed by the precious relic. The exhibition of the holy coat in 1844 led to the secession of the "German Catholics" from the Catholic Church. The seamless coat of Jesus is also said to be preserved in the church at Argenteuil, near Versailles, but this claim is not considered well founded. The legend here is that it was given by Charlemagne to the monastery located there, his daughter Theodrada being abbess. Consult: Beissel, *Geschichte des Heiligen Rockes* (Treves, 1889); Clarke, *Pilgrimage to the Holy Coat of Treves* (London, 1892); Plater, *The Holy Coat of Treves* (ib., 1891).

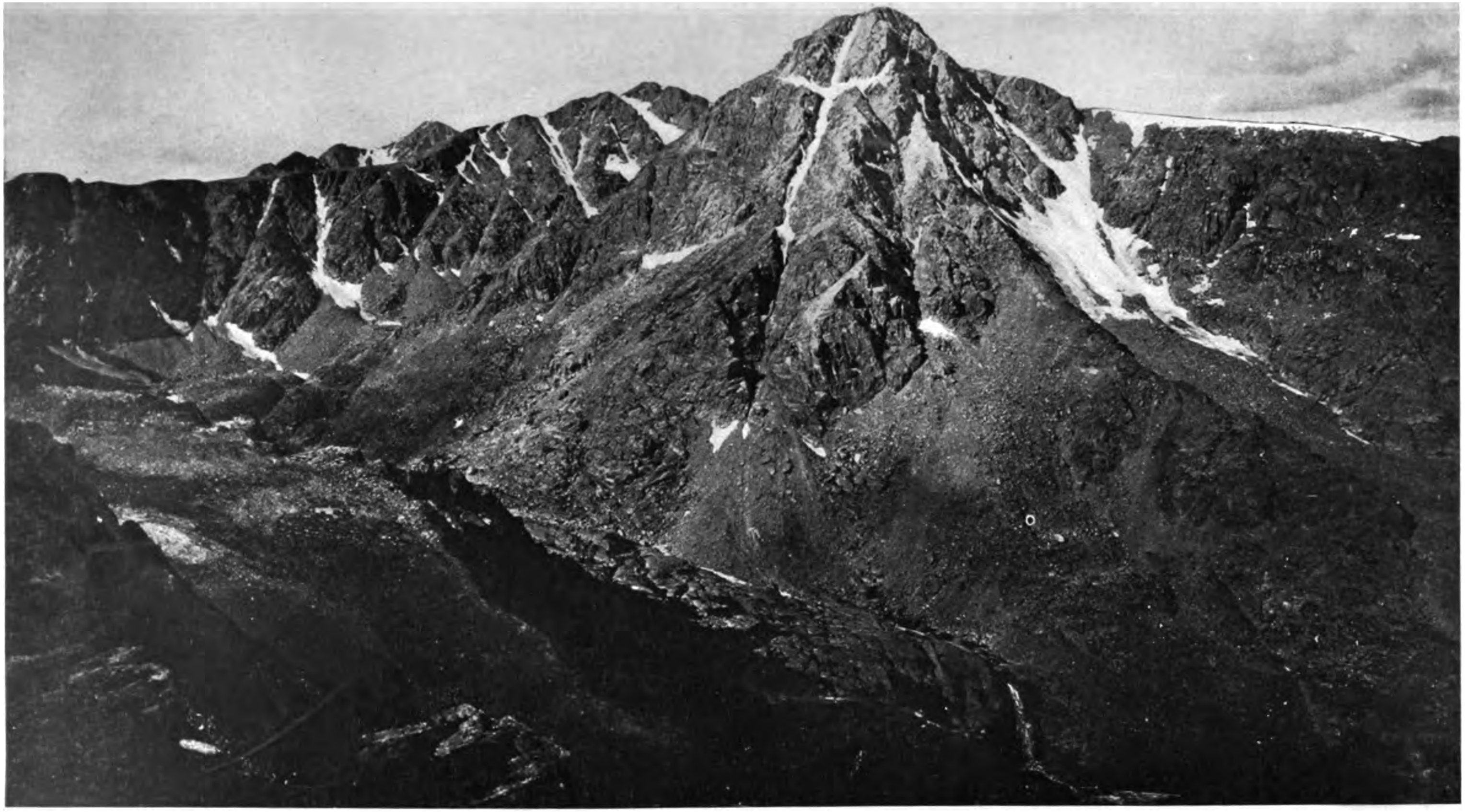
HOLY COMMUNION. See Lord's Supper.

HOLY CROSS, College of the. A Roman Catholic educational institution founded in 1843 and situated at Worcester, Mass. It is under the control of the Fathers of the Society of Jesus. It maintains collegiate and preparatory departments, and had in 1903 385 students, of whom 175 were in the preparatory school. At the same time its library contained 24,000 volumes, the buildings and grounds were valued at $490,000, and the annual income was $20,000.

HOLY CROSS MOUNTAIN. A celebrated peak of the Rocky Mountains in Colorado, situated in Eagle County, in the central part of the State, 15 miles northwest of Leadville. Its height is 14,006 feet. It derives its name from two snow-filled ravines, which cross each other at right angles, and present from a distance the appearance of a white cross.

HOLY DYING, Rule and Exercises of. A devotional manual, by Jeremy Taylor, published in 1651. It reached a twenty-first edition in 1710; has been frequently republished during the nineteenth century; and may be said, with its equally popular companion tractate, *Rule and Exercises of Holy Living* (1650), to offer a summary of the duties and devotions necessary to a Christian life.

HOLY FAMILY. The name given in art to representations of the Virgin and the Infant Saviour and their attendants. The earliest such composition is that in the Catacomb of Saint Calixtus in Rome, with the Prophet Isaiah. The Virgin is represented sitting on a seat, which soon became a throne, the traditional attitude up to the Renaissance. The Byzantine School, as early as the sixth century, invented the type in which the Child is seated directly in the centre of the Virgin's lap, and is blessing, both figures gazing straight forward. Some of these early pictures were regarded as painted by Saint Luke and endowed with miraculous powers. Such are a number in the churches of Rome (e.g. at San Sisto, Santa Maria Maggiore, etc.), and Venice (e.g. that of Saint Mark, brought from Saint Sophia in 1204). Later, this school added attendant angels, who sometimes, as in the school of Candia, bore the emblems of the Passion, the sight of which affrights the Child. The arrangement in which the angels are throne-bearing and adoring figures, in rhythmic arrangement on either side of an immense throne, was developed very beautifully by Cimabue and Duccio in their famous pictures at Florence and Siena. It was quite late in the Middle Ages when other figures were brought into the composition. These were, especially, Saint Anna, the mother of the Virgin (sometimes holding the Virgin in her lap), Saint Joseph, and as playmates to the Infant Christ, the infant John the Baptist (usually in goat-skin and bearing a cross), or Saint Catharine (with whom Christ is being sometimes mystically married). Even the early legendary history of the infancy of Christ has been drawn upon for such scenes as the Twelve Apostles playing with the Infant Christ as boys—a scene peculiar to German art. Of all subjects of Christian art that of the Madonna and Child, comparatively unknown before the thirteenth century, came into overwhelming prominence, becoming the favorite theme of the Italian painters of the Renaissance. Giovanni Bellini, Perugino, Filippo Lippi, Leonardo, Raphael, and Andrea del Sarto may be mentioned among the many who frequently treated it. One of its variants at



MOUNTAIN OF THE HOLY CROSS

that time was the adoring Virgin on her knees before the Infant (Filippo Lippi). The scene of the Holy Family must be distinguished from the more elaborate scenes in which the Virgin and Child, similarly portrayed, are accompanied by several large figures, saints and fathers of the Church, which are not mere accessories of the sacred group; this is usually termed a *Sacra* (or *Santa*) *Conversazione,* and was a popular scene, especially with the Umbrian, Venetian, and northern schools of the fifteenth and sixteenth centuries.

HOLY GHOST, or Holy Spirit. In orthodox theology, the third person of the Trinity (q.v.), "proceeding from the Father and the Son," yet of one substance, majesty, and glory with the Father and the Son, very and eternal God. That the Holy Spirit is God is attested by passages of Scripture ascribing to Him the same names and attributes as to God (II. Cor. iii. 16, 17; II. Tim. iii. 16; II. Peter i. 21). He is distinct from the Father and the Son (Matt. xxviii. 19; II. Cor. xiii. 14; I. Peter i. 1-4), and this distinction is of a personal nature, similar to that between the Father and the Son, proved by many passages, such as John xv. 26: "But when the Comforter is come, whom I will send unto you from the Father, even the Spirit of truth, which proceedeth from the Father, He shall testify of Me." The "procession" (q.v.) of the Spirit is the subject of one of the chief differences between the Eastern and the Western churches. The Holy Spirit is essentially a spirit of holiness, and His grand function is to apply to the hearts of men the benefits of Christ's death, to regenerate them, and then to sanctify them by the truth.

HOLY GHOST, Order of the (Fr., *l'Ordre du Saint-Esprit*). The name of an order of knighthood founded in 1578 by Henry III., King of France, because on Pentecost, 1573, he had been elected King of Poland, and on Pentecost, 1574, had succeeded to the French throne. The grand master of the order was always to be the King of France. The insignia were a green cross with eight points, on the obverse of which was a dove turned downward, on the reverse the representation of the archangel Michael; the chain, after Henry IV., bore the lilies of France and the monogram 'H.' There were one hundred knights, without counting foreigners. The order was definitely dissolved on February 10, 1831, by Louis Philippe.

HOLY GHOST FLOWER, or Dove Flower. See Holy Spirit Plant.

HOLY GRAIL. See Grail, Holy.

HOLY GRASS (*Hierochloë borealis*). A grass about a foot high, with a brownish glossy lax panicle. It is found in the North of Europe, and throughout North America. It has a sweet smell, like that of sweet vernal grass; and in Iceland, where it is plentiful, it is used for scenting apartments and clothes. In some countries it is strewn on the floors of the places of worship on festival days, whence its name. Its stems are used by North American Indians to weave into their baskets, mats, etc. It is of little value for forage, as stock seem to dislike it. This grass is known by many other names, as vanilla grass, seneca grass, sweet-scented grass, etc.

HOLY GROTTO. The traditional scene of the Annunciation, at Nazareth. Over the grotto stands a monastery, occupying the site of the Santa Casa, the house in which Mary was born, and which was carried by a miracle to Loreto. The grotto is marble-lined and is lighted by nine silver lamps. It is 20 feet square and 10 feet deep.

HOLYHEAD, hŏl'ĭ-hĕd. A seaport of Anglesey, North Wales, situated on the little island of Holyhead, 24½ miles west-northwest of Bangor (Map: England, B 3). It is the terminus of the London and Northwestern Railway, and the port for the mail steamers to Dublin, 60 miles distant. It has a celebrated breakwater, 7860 feet long, which forms a harbor of refuge of 400 acres. It has three lighthouses. Coasting trade, ship-building, and rope-making are carried on. The town possesses assembly rooms and baths and a picturesque old embattled church. Interesting Roman and early English remains exist in the neighborhood. The United States is represented by a consular agent. Population, in 1891, 8745; in 1901, 10,072.

HOLYHEAD ISLAND. A small island of North Wales, west of the island of Anglesey, forming part of the county of that name (Map: Wales, B 3). Its area is about 6000 acres. Population, in 1891, 10,000; in 1901, 11,414.

HOLY ISLAND, or Lindisfarne. A small island belonging to Northumberland, England, in latitude 55° 40′ N., longitude 1° 47′ W., 10 miles southeast of Berwick-on-Tweed and 3 miles north of the Farne Islands (Map: England, E 1). It is about 4 miles long and 2 miles broad, and is connected with the mainland at low water by sands 3 miles in extent. On the south coast is the village of Holy Island, much resorted to by summer visitors. On the island are several ruins, the chief of which are the extensive and sombre-looking remains of the famous Abbey of Lindisfarne, originally a Saxon edifice, founded in 635 by Aidan, the disciple of Saint Columba. There is also an ancient castle, now fortified. Holy Island flourished under Saint Cuthbert, who died here in 687. In 793 the abbey was destroyed by the Danes. Consult Wilson, *Lindisfarne Churches* (1870). Population 700.

HOLY LANCE. The lance with which the Saviour's side was pierced, and according to one account, found at Jerusalem by Saint Helena, carried to Constantinople, and sent from there in 1492 to the Pope; now preserved in Saint Peter's. According to another account, it was lost until discovered by the Crusaders at Antioch, June 14, 1098. This discovery encouraged them so that they won a great victory. In 1104 this lance was presented to the Byzantine Emperor. The holy lance plays a prominent part in the legends of the Holy Grail (q.v.).

HOLY LAND. See Palestine.

HOLY LEAGUE. The name given to a number of political alliances in Europe. Of these the principal were the leagues formed (1) in 1511, by the Pope, Spain, and Venice against France; (2) in 1527, by the Pope, Francis I., and Henry VIII. against the Emperor Charles V.; (3) in 1538, by Charles V. and the Catholic princes of Germany against the Schmalkaldic League; (4) in 1571, by the Pope, Spain, and Venice against the Turks; (5) most important of all, the one formed in 1576 by the Guises, the Pope, Spain, and the Parlement of Paris against the Huguenots. In 1609 a Holy League (known as the Catholic League) was organized by the Catholic States of Germany, with Bavaria at its head, in opposition to the Protestant Union.

HOLY MAID OF KENT. See Barton, Elizabeth.

HOLY MOTHER OF THE RUSSIANS. An epithet originally given to Moscow, the former capital of Russia, by the masses of that nation, and still preserved among the peasantry.

HOL'YOAKE, hŏl'yŏk, George Jacob (1817-1906). An English writer, lecturer, and reformer, particularly identified with the 'coöperative movement.' He was born in Birmingham, England; was educated at the Mechanics' Institution there, taught mathematics for a time, and while still young became widely known as a radical in politics and religion, attracting attention in particular by his advocacy of the theories of Robert Owen (q.v.). He early became especially interested in the theory and practice of coöperation, was active in the movement for the organization of the so-called 'Rochdale Pioneers' in 1843, and subsequently was largely engaged as a lecturer and writer in the interests of coöperation. In 1842 he was imprisoned for six months for blasphemy, his being the last conviction on that charge in England. Soon afterwards he devised a moral system, known as 'secularism' (q.v.), which he advocated in public speeches and in the press. For a time he was president of the London Secular Society, the central organization of Secularism. He was instrumental in securing the repeal of the so-called 'tax upon knowledge' in 1854. He edited at various times the *New Moral World,* the *Reasoner* (from 1846 to 1866), and the *Cause of the People,* in which he contended vigorously for his views; and published numerous books, including: *History of the Rochdale Pioneers* (1857); *The History of Coöperation in England* (1875); *Life of Joseph Rayner Stephens, Preacher and Political Orator* (1881); *Self Helps One Hundred Years Ago* (1890); *The Coöperative Movement of To-Day* (1891); *Sixty Years of an Agitator's Life* (1892), an interesting though somewhat rambling autobiography; *Nature and Origin of Secularism, Showing that Where Free Thought Commonly Ends Secularism Begins* (1896); and *Jubilee History of the Leeds Coöperative Society* (1897).

HOLYOKE, hōl'yôk. A city in Hampden County, Mass., 8 miles north of Springfield; on the Connecticut River, and on the Boston and Maine and the New York, New Haven and Hartford railroads (Map: Massachusetts, B 3). It was originally a part of West Springfield, and was incorporated as the Third Parish in 1786, though it was commonly called Ireland Parish, from the fact that several Irish families were the first settlers. In 1850 Holyoke was set off from West Springfield and incorporated as a separate town; and in 1873 it was chartered as a city. Its importance as a manufacturing centre dates from 1847, when the Hadley Falls Company began to develop the great natural water-power. The river here falls 60 feet and is crossed by a dam 1000 feet long, affording the most valuable power in New England. For many years it was noted for its paper-mills, but it now has also extensive manufactures of cottons, woolens, thread, silk, alpaca, bicycles, automobiles, belting, bricks, screws, wires, machinery, envelopes, and school supplies. It is an important centre for hydraulic engineering, for testing water-wheels, etc. There are a public library, a college of music, city hospital, and House of Providence Hospital. The Holyoke Scientific Society has done valuable work in American archæology, and has fine collections of Indian antiquities. In the vicinity are many points of scenic interest, notably Mount Tom (1215 feet), ascended by an electric railway from Holyoke, and Mount Holyoke (955 feet). Holyoke is governed under a revised charter of 1896, by a Mayor, elected annually, and a city council, two-thirds of whose members are elected at large for two years, the remainder by wards for one year. The subordinate offices are filled as follows: appointed by the Mayor—board of public works, fire commissioners, board of health, city marshal and assistants, city solicitor, and inspector of milk; appointed by the Mayor with the consent of the council—sealer of weights and measures and inspectors of animals and provisions; elected by the council—water commissioners, city physician, poor overseers, city auditor, and city messengers; by the people—all others. The annual income and expenditures of the city amount to about $1,780,000 and $1,745,000 respectively, the main items of expense being $50,000 for the police department, including amounts for police courts, jails, etc.; $70,000 for the fire department, and $175,000 for schools. The city owns and operates its water-works, and has voted to acquire the gas and electric-light plants. Population, in 1890, 35,637; in 1900, 45,712. See Mount Holyoke College.

HOLYOKE, Mount. A steep ridge of greenstone 5 miles southeast of Northampton, Mass., rising 955 feet above sea-level (Map: Massachusetts, B 3). A carriage-road winds upward to the point where a mountain railway carries passengers up a precipitous incline to a hotel built on the summit in 1821. The view here obtained of the Connecticut River and valley has long been famous as one of the finest in New England.

HOLY PHIAL, Order of (Fr. *Sainte Ampoule*). The name of an order of knighthood which formerly existed in France. It was composed of four persons, usually the first in point of rank, family, and fortune in the Province of Champagne, who were styled *Barons de la Sainte Ampoule.* At the coronation of the French kings, they were delivered to the dean, priors, and chapter of Rheims, as hostages for the return of the holy phial in which the coronation oil was kept. The phial, according to legend, was brought from heaven by the Holy Ghost in the form of a dove and put into the hands of Saint Remigiris at the coronation of Clovis (q.v.). The holy phial preserved at Rheims was broken by Ruhl, a member of the Convention, in 1793. The badge of the order was a cross of gold enameled white, cantoned with four fleurs-de-lis, and on the cross a dove descending with a phial in its beak, and a right hand receiving it.

HOLY ROMAN EMPIRE. The name now given to the Empire erected by Charles the Great (q.v.), King of the Franks, in Western Europe, usually dated from his coronation, at Rome, by Pope Leo III. in 800; or, more technically, to this Empire as revived in 962 by Otho the Great (q.v.). In theory the Holy Roman Empire was a continuation of the Western Empire, which was overthrown by the barbarians in 476. When Charles the Great was crowned Emperor by Leo III. he thought of himself as the successor of Augustus, Trajan, and Marcus Aurelius, and styled himself Augustus. This theory prevailed throughout the Middle Ages. Louis the Pious, Lothaire I., Louis II., Charles the Bald, and Charles the Fat were crowned as Roman emperors. After the deposition of the latter (887), which was followed by the disruption of the great Frankish Empire, the Imperial title was still held by a few princes, as Arnulf, King of Germany, and Berenger I., King of Italy. In 962 Otho the Great, after wresting the royal crown of Italy from a descendant of Charles the Great, had himself crowned Emperor of the Romans by Pope John XII., and inaugurated the Roman Empire of the German nation. From that time the King of Germany was usually Emperor. The Empire consisted of Italy and the lands whose rulers recognized the overlordship of the German monarch; but theoretically the Emperor was the ruler of all Christians in Western Europe, and some emperors, as, for example, Henry VI.. dreamed even of a world-wide empire. At different periods the rulers of Hungary, Poland, Denmark, Jerusalem, and Cyprus were to a greater or less extent vassals of the Roman Emperor. Until the reign of Frederick Barbarossa the name had been merely 'Roman Empire;' Frederick added the designation 'Holy,' either to vindicate its sacred character against the exclusive pretensions of the Church, or else to describe its chief function as the protection of that Church. By the close of the thirteenth century the authority of the German emperors in Italy was reduced to a mere shadow. At the close of the fifteenth century the Swiss cut loose completely from the Empire. In the Netherlands the Imperial authority had come to an end long before their connection with the Empire was declared to be severed in an article of the Peace of Westphalia (1648).

The early German kings were elected by the chief men of the nation with the assent of the other freemen. Gradually the chief nobles secured almost entire control of the elections, but there was no fixed mode of procedure. At the election of Lothair in 1125, for example, a committee consisting of ten from each duchy was chosen to select an Emperor. In the thirteenth century—by a process of evolution, which it is not possible to trace now—the number of electors had been fixed at seven, but there was a dispute as to who were included in the seven. This was settled in 1356 by the Golden Bull of Charles IV., which determined that the electoral college should be composed of the Archbishops of Mainz, Treves, and Cologne, the King of Bohemia, the Count Palatine of the Rhine, the Duke of Saxony, and the Margrave of Brandenburg. The Golden Bull also declared that the electoral votes were attached to the office, not to the persons, and descended in the case of the lay principalities by right of primogeniture. This continued to be the constitution of the electoral college until 1623, when Ferdinand II. arbitrarily transferred the vote belonging to the Count Palatine to Maximilian of Bavaria. At the Peace of Westphalia (1648) an eighth electorate was created for the Palatinate. In 1692 the ninth electorate, that of Hanover, was instituted. The Imperial elections were held at Frankfort-on-the-Main and the coronation city was Aix-la-Chapelle. The Emperor at some time during his reign went to Rome to receive the Imperial crown at the hands of the Pope. The last ceremony of this kind took place in 1530, when Charles V. was crowned at Bologna by Pope Clement VII. The successor-elect to the Emperor of the Romans was styled King of the Romans.

During the so-called Interregnum following on the death of the last Hohenstaufen Emperor there was a double election (1257), both Richard of Cornwall and Alfonso X. of Castile being made Emperor, one receiving four votes and the other three. Their election may be taken to illustrate the theory held by some at the time, that a man of any nationality might be chosen to the Empire; but their total failure to obtain anything but the mere Imperial title proved that as a matter of fact the sovereignty of the Holy Roman Empire could be held only by a Germanic prince. After 1438 all the emperors but two belonged to the House of Hapsburg.

Charles the Great and his immediate successors followed the old German custom of calling together, at frequent intervals, the nobles and freemen for consultation about the public welfare. As feudalism developed these assemblies ceased, and the Emperor called together only such of his vassals as he chose. Their meetings were called Imperial Diets (*Reichstage*). In the thirteenth century the cities became very influential, and consequently their representatives were summoned to the Diets. As the power of the emperors declined, the Diets took a more prominent part in the administration of the Empire. Their functions were judicial as well as administrative. In the fourteenth century it came to be fixed that the Diet consisted of the three classes: electors, princes, and representatives of the cities. The lesser nobility had no voice in the Diet. But the power of the Diet was slight, because it was concerned only with Imperial matters, and the Empire had ceased to be of real importance as a factor in European politics. This was clearly shown in 1496, when Maximilian I. attempted to unite the Imperial estates against the French invasion of Italy. The Diet which he summoned did nothing to check the French, but with the Emperor's consent created the Imperial Chamber (q.v.) a supreme tribunal for the preservation of peace within the Empire. It consisted of a president and sixteen members, who could not be removed from office. It held its sessions at Frankfort, Speyer, and other cities until 1698, when it was established permanently at Wetzlar. Gradually the Imperial Chamber became an important factor in the maintenance of peace within the Empire. The Emperor was jealous of it, as he had no control over it. Consequently he attempted to transfer some of its authority to the Aulic Council (q.v.), a somewhat similar body for Austria, which was under his control. During the first half of the sixteenth century the Aulic Council interfered in the affairs of Italy, the Netherlands, and other portions of the Empire. After that time, however, it was again restricted to Austrian interests alone.

The Empire came to an end in 1806, when Francis II. resigned the Imperial crown after having assumed (1804) the title of Emperor of Austria. After the time of the Hohenstaufen, whose dynasty came to an end in 1254, the Empire rapidly sank in importance, and owed any real authority which it possessed to the strength of the ruler who was Emperor. Still the possession of the title gave some additional prestige. By the Peace of Westphalia (1648) the bonds which held the Empire together were greatly loosened, the right being accorded to the individual States to enter into foreign alliances. In the eighteenth century Voltaire said of the Holy Roman Empire that it was neither holy, nor Roman, nor an empire. During its earlier existence, however, it was a very important factor in the history of Europe. Consult: Bryce, *The Holy Roman Empire* (London, 1864); Fisher, *The Mediæval Empire* (2 vols., London, 1898). See GERMANY; ITALY, and the articles on the individual emperors, with the books cited.

HOLYROOD (hŏl′ĭ-ro͞od) **PALACE.** The former residence of the Scottish Kings in Edinburgh. It was rebuilt between 1671 and 1679 by King Charles II. of England from the designs of Sir William Bruce of Kinross, after the almost total destruction by fire in 1560 of the prior palace built by James IV. It occupies the site of the famous Augustinian Abbey of the Holy Rood erected by King David I. in 1128, at the place where, according to a fabulous story, he was miraculously saved from the attack of a hunted stag by the interposition of the lost holy cross or rood which fell from the stag's antlers into the King's hands, and at the sight of which the animal turned and fled. The black rood of Scotland, as it was called, was brought to Scotland by Saint Margaret about the year 1070 and became one of the kingdom's heirlooms. It is known to have fallen into the hands of the English at the battle of Neville's Cross in 1346, but its disappearance, in course of time, gave currency to the above fable. The sole remains of the abbey are the ruins of the church which, anciently, was a safe refuge for criminals, and remained so for debtors until the abolition of imprisonment for debt in 1880. Holyrood is interesting as the scene of many historical events, including the term of Queen Mary's residence and of Rizzio's murder in 1566. It is the occasional residence of the British sovereigns, and since the death of Queen Victoria has undergone thorough renovation. Consult: *Historical Description of the Monastery and Chapel Royal of Holyrood House* (Edinburgh, 1819); Wilson, *Memorials of Edinburgh* (Edinburgh, 1848).

HOLY SEPULCHRE. The place where Jesus was entombed. According to the New Testament data, the sites of the crucifixion and burial of Jesus were not far apart (John xix. 41), outside Jerusalem (Heb. xiii. 12), and near a road (Mark xv. 29; Matt. xxvii. 39). The tomb itself was in a garden (John xix. 41), and apparently on a slope. The place of crucifixion was called Golgotha (Mark xv. 22; Matt. xxvii. 33; John xix. 17), an Aramaic word meaning skull. Calvary is but the anglicized form of the Latin *calvaria*, skull. There is no evidence for supposing that the locality was sufficiently elevated to be called a hill or mount. The Gospels imply that the site was well known when they were written, but the references are not full enough to make a modern identification easy or certain.

The traditional site of both Golgotha and the tomb of Jesus is that now covered by the Church of the Holy Sepulchre, 400 to 500 yards west of the northern part of the Haram esh-Sherif, or temple area, and well within the modern city of Jerusalem. Here Constantine the Great built a beautiful church on the spot then supposed to be the place of the Ascension. This identification was not seriously disputed until Jonas Korte, in 1741, claimed that, being within the city walls, it could not be correct. Korte supposed that the modern north wall was in existence at the time of the crucifixion, but in fact it was built later. In 1841 Edward Robinson, in his *Biblical Researches*, disputed the correctness of the traditional site, on the supposition that the second wall of Josephus—i.e. the north wall in Christ's day—passed to the north of it, and in that case it must have been within the city. Since Robinson, this has been felt to be the chief and fatal obstacle to the view that the modern church actually covers the spot where Jesus was buried. But the excavations and measurements of Conrad Schick (1888 and later) have made it all but certain that the wall in Christ's day lay south and east of the disputed site, which therefore was outside the city, and may well have been the scene of the crucifixion and burial. Of other proposed sites, two, both outside the modern city, near the Damascus Gate, have received strong support. The question is still unsettled, but the drift of competent opinion is toward acceptance of the traditional view.

A few years after the crucifixion, the northern area of Jerusalem was inclosed by a third wall, as it was becoming thickly settled. There is no reason to suppose that the early Christians forgot where the crucifixion and burial had occurred, though there is no probability that they venerated the place as holy. In the Jewish war with Rome (66-70), this part of the city was occupied by the Roman army preparatory to the assault on the second wall. From its capture by Titus (70) to the rebellion of Bar-Cochba (132-35), the city was practically in ruins, though not entirely desolate. After suppressing this rebellion Hadrian rebuilt Jerusalem as a heathen city, calling it Ælia Capitolina, and absolutely forbidding Jews to enter it. On the site of the temple a shrine to Jupiter was built, and on that of the supposed tomb of Jesus a temple to Venus was erected (by Hadrian or one of the later emperors). Incidentally this may be evidence that even then Christian tradition pointed out that spot as worthy of veneration. In the third century the holy places of the city and vicinity began to attract pilgrims from various parts of the Empire, though there is no evidence that any visited this particular spot. In the fourth century the pilgrimages became more popular, and when through Constantine I. the Empire became nominally Christian, it was but natural that the Emperor, urged on, doubtless, by his mother, determined to rescue the holy sepulchre from oblivion and disgrace. What guided Constantine in selecting this spot was, without doubt, the tradition already current. On removing the accumulated rubbish, the workmen came upon a rock tomb. So astonishing was this coincidence that it was counted as simply miraculous that the precious grave, so long hidden away, should at last have come to light. Legends soon began to multiply—e.g. that Helena, Constantine's mother, miraculously discovered the true cross near by, of which Eusebius, the contemporary and well-informed witness, says nothing. (See CROSS, INVENTION OF THE.) Constantine now built here a magnificent church. Over the grave was erected a beautiful gilded dome open to the sky, supported by columns and surrounded by a wall, the inside diameter being about 65 feet. From the rotunda eastward extended the basilica, 250 feet in length, with its nave and two aisles, the nave ending in a semicircular choir. Still further to the east, connected with the basilica by three gateways, was the atrium, surrounded with colonnades and containing basins for the customary ablutions. From the atrium three gates led out into the propylæum, which connected the whole edifice with the market street to the east. The entire length of the church or cathedral so constructed was about 475 feet. It was due, doubtless, to the necessities of the situation that the propylæum and atrium were to the east rather than, as usual, west of the basilica. In the south aisle, a knob of the native rock, with a cleft in it (the grave of Adam, according to legend), rose a few feet above the level of the floor, inclosed within a silver fence. This was supposed to be the rock in which the cross was set—i.e. Golgotha proper. In A.D. 336, ten years after its foundation, Constantine's church was dedicated by the Synod of Tyre. For nearly three hundred years the edifice remained intact, famed for its beauty, one of the chief attractions for the numerous pilgrims constantly visiting Jerusalem. During this period legends grew apace, and numerous miraculous events were associated with the locality. In 614 the church was destroyed, at least partially, by the Persians under Chosroes II. Steps were taken at once by Modestus, acting Bishop of Jerusalem, to rebuild the edifice, and after ten years' labor (616-26) the work was completed. The new buildings were not of the same plan or dimensions or beauty as their predecessor. The rotunda was rebuilt as a separate church—of the Resurrection—and on the site of the large basilica of Constantine a smaller one, the Martyrium, over the place where the cross was said to have been found, was erected. Southeast of the rotunda a new church in honor of the Virgin was built, while over Golgotha, now outside of the basilica, a chapel was placed. These edifices remained, with occasional damage and consequent repairs, until their destruction by Hakim, Caliph of Egypt, in 1010. With the assistance of the Byzantine Emperor they were restored in 1048, with some changes of plan. In 1140 the Crusaders began a general rebuilding of all the edifices on a larger scale. The new church was dedicated July 15, 1149, but not completed until 1168. The Church of the Crusaders was destroyed in 1244, but again rebuilt (c.1300). Extensive alterations and improvements took place in 1555 and 1719. In 1808 the rotunda was burned and much other damage done to the western buildings. The restoration, the work of the Greeks and Armenians, was completed in 1810. Since that time, with the exception of the renewal of the dome in 1868 by Napoleon III. and Alexander II. of Russia, the buildings have undergone no serious alteration.

For plan of the present buildings, with extended descriptions, consult Baedeker's *Palestine and Syria* (Leipzig, 1898); for the plan and extent of the buildings of Constantine, Mommert, *Die heilige Grabeskirche zu Jerusalem in ihrem ursprünglichen Zustande* (Leipzig, 1898); for the best bibliography, Guthe's article in the Hauck-Herzog *Realencyklopädie* (Leipzig, 1899).

HOLY SEPULCHRE, KNIGHTS OF THE. An order of knighthood instituted, probably by Pope Alexander VI., for the guardianship of the Holy Sepulchre, and the relief and protection of pilgrims. The Pope was originally the grand master, but he subsequently ceded his rights to the Guardian Father of the Holy Sepulchre at Jerusalem. The knights were held to strict rules of honor, faith, and purity, but in return they had the most unusual and extraordinary privileges conferred on them. They were exempt from taxation, could marry, could, as an organization, possess property, could legitimatize bastards, and could cut down and bury the bodies of criminals who had been hanged. After a temporary union with the Hospitalers, the order was reconstructed in 1814, both in France and in Poland, and is still in existence, its members being chosen by the Guardian of the Holy Sepulchre out of noble and devout pilgrims. The badge of the order consists of a cross potent of red enamel, with four similar smaller crosses between its arms, surmounted by a crown and held by a black ribbon. The collar is made up of small crosses like the badge.

HOLY SPIRIT. See HOLY GHOST.

HOLY SPIRIT PLANT, or DOVE PLANT. Names given to a species of orchid, *Peristeria elata*, found in Central America, especially in the vicinity of Panama. It is an epiphytic orchid, with large, striated green pseudobulbs, which bear three to five lanceolate leaves, often a yard long and six inches across. The flower-stem springs from the base of the pseudobulbs, and is four to six feet high, a third of its height bearing creamy-white, fragrant flowers, an inch or more in diameter, the inner part of which is often tinged with crimson or other shades of red. The name is derived from the shape of the united column of style and stamens. This column resembles a conventional dove hovering with expanded wings in the vase formed by the petals. It is used in religious festivals in Central America as symbolical of the Holy Spirit; hence its name, 'el spirito santo.' See ORCHID.

HOLY STONE. A miraculous rock at Ardmore, Ireland, which is said to have floated from Rome with robes, a bell, and a lighted taper for Saint Patrick.

HOLYSTONE. A piece of soft stone, usually sandstone, used in scrubbing decks. To holystone a deck is to scrub it, using holystones. Holystones are smooth on one side at least, and have a small depression on the other to receive the end of a handle or stick by which they are pushed back and forth. To increase the scrubbing power of the stones, the decks are wetted and sand is sprinkled over them prior to holystoning. The derivation of the term is supposed to be from the fact that holystoning used chiefly to be done on Saturday as a preparation for Sunday inspection, church, etc.

HOLY THURSDAY. See ASCENSION DAY; HOLY WEEK.

HOLY WAR, THE. (1) The first of Thomas Fuller's historical writings (1639). It is a history of the Crusades, and very popular up to the time of the Restoration. (2) A religious allegory, explained on the title-pages as "made by Shaddai upon Diabolus," by John Bunyan (1682).

HOLY WATER (Lat. *aqua benedicta*). Water blessed by a priest for religious uses, and employed in the Roman Catholic and Oriental churches. In most ancient religions, the use of lustral or purifying water not only formed part of the public worship, but also entered largely into the personal acts of sanctification prescribed to individuals. The Jewish law contained many provisions to the same effect; and Christ, by establishing baptism with water as the necessary form of initiation into the religion instituted by Him, gave His sanction to the use. The usage of sprinkling the hands and face with water before entering the sanctuary, which was prescribed in the Jewish law, was retained, or at least very early adopted, in the Christian Church. It is expressly mentioned by Tertullian in the end of the second century. And that the water so employed was blessed by the priests we learn from Saint Jerome, and from the Apostolic Constitutions, which contain a formula for the purpose. That now given in the Roman missal and ritual has been preserved unaltered from the sacramentary of Saint Gregory. It includes an exorcism (q.v.) and the admixture of salt which has been blessed. The water so prepared is sprinkled by the priest on the congregation before high mass (this rite being called the *Asperges*, from the first word of the anthem which is sung during its progress), and is publicly employed as part of the rites for funerals and for the blessing of various objects and persons; that used in the consecration (q.v.) is prepared in a special manner. The ordinary holy water is also used privately by devout Roman Catholics on entering and leaving the church, and at other times. It is considered by them as included among sacramentals (q.v.). Although it is difficult to fix the precise time, it cannot be doubted that the practice of mingling salt with the water is of very ancient origin.

HOLY WATER VASE, or STOUP. A receptacle, known in France as *bénitier*, for holy water, placed at the entrance of Roman Catholic churches, so that those who come in or go out may dip their fingers in it and cross themselves. It is frequently in the form of a shell and usually attached to the wall. The kind of a vessel known as *pila* in Italy stands on a base of its own.

HOLY WEEK. The week immediately preceding Easter, and especially consecrated to the commemoration of the passion of Christ. In the Roman Catholic Church, the special characteristics of the celebration of the Holy Week are increased solemnity and gloom, penitential rigor, and mourning. If any of the ordinary Church festivals fall therein, it is transferred till after Easter. All instrumental music is suspended in the churches, the altars are stripped of their ornaments, the pictures and statues are veiled from public sight; manual labor, although it is no longer entirely prohibited, is by many persons voluntarily suspended; the rigor of fasting is redoubled, and alms-deeds and other works of mercy sedulously enjoined and practiced. All Church services of the week, moreover, breathe the spirit of mourning, some of them being specially devoted to the commemoration of particular scenes in the passion.

Palm Sunday commemorates the triumphal entry of Christ into Jerusalem, and is observed by the blessing of palm branches, which are carried in the procession as they were by the people of Jerusalem on that day. Spy Wednesday is the old English name for the day which commemorates the betrayal of Christ by Judas. Holy Thursday (also called Maundy Thursday) is the commemoration of the Last Supper and the institution of the Eucharist. With this in mind, white vestments are worn at the mass (only one mass is celebrated on this day), after which the altars are solemnly stripped and washed by the clergy. (See also FOOT-WASHING.) The matins of the last three days, generally sung on the preceding evening (see TENEBRÆ), constitute an impressive service. On Good Friday the mass is not celebrated, the day being the commemoration of the one sacrifice of the great High Priest; but a special service is held, called the 'mass of the presanctified,' including the communion of the priest from the host reserved from the previous day on the 'altar of repose.' (For the ceremony of the 'adoration of the cross,' see CROSS.) Holy Saturday was in the earliest times set aside for the solemn administration of baptism and orders; the present services of the day begin to partake of the gladness of Easter (q.v.). In the Anglican communion the observance of the week in a similar spirit is prescribed, and the Scripture selections all have a bearing upon the events commemorated. Good Friday is a legal holiday in England and Ireland, and its observance is largely increasing, even among the non-liturgical denominations throughout the English-speaking world.

HOLYWELL, hŏl'ĭ-wĕl. A municipal and Parliamentary borough and market-town in Flintshire, North Wales, 4½ miles northwest of Flint (Map: England, C 3). It has limestone quarries, coal and lead mines, and numerous establishments for smelting, manufacturing shot, zinc, etc. There are also manufactures of cottons, flannels, and galloons, paper, and Roman cement. Holywell owes its origin to the renowned well of Saint Winifred, which is said to be the most copious spring in Britain. Its waters were believed to be efficacious in curing diseases, and are still resorted to by Roman Catholic pilgrims. The well is covered by a fine Perpendicular chapel attributed to Margaret, mother of Henry VII. In the vicinity are remains of the old Saxon Abbey of Basingwerk, and in the town is Saint Buenos College for Roman Catholic priests. Population, in 1891, 2894; in 1901, 2652.

HOLZ, hôlts, ARNO (1863—). A German poet and critic, born at Rastenburg. Before he was nineteen he was engaged in journalism, and in 1882 published a volume of poems, *Klinginsherz*, which won the Augsburg Schiller Prize. In a second volume, *Deutsche Weisen* (1884), written with Jerschke, and in the *Buch der Zeit* (1885 and 1892), his extremely modern tendency appears, and the attention to details and the attempt at photographic realism is carried even further in *Neue Gleise* (1892), in which he collaborated with Johannes Schlaf. His realistic theory is further illustrated in the plays *Socialaristokraten* (1896) and *Die Blechschmiede* (1902), the latter a satiric dialogue, and is defended by Holz in *Die Kunst* (1891 et seq.), and *Revolution der Lyrik* (1899).

HOLZBAUER, hōlts'bou'ĕr, Ignaz (1711-83). An Austrian composer, born in Vienna. Despite the opposition of his parents, who intended him for the law, he studied music, and in 1745 became kapellmeister to Count Rottal and at the Court Theatre of Vienna. He was later kapellmeister at Stuttgart and at Mannheim. He spent much of his time in Italy, where most of his operas were produced. They were popular, and include: *Il figlio delle selve* (1735); *Alessandro nell' Indie* (1759); and *La clemenza di Tito* (1780). He composed, in addition, a great quantity of Church music, and excellent concertos, string quartets, and 196 symphonies. He died at Mannheim.

HOLZSCHUH, hōlts'shōō, Dietrich. A German pretender, also called Tile Kolup. He laid claim to the throne as Frederick II., who died in 1250. In Cologne (1284) his claim was ridiculed, he was ducked in a sewer, and driven from the city. At Neuss he fared better, and in 1285 went to Wetzlar and there held court; but on the approach of Rudolf he was turned over to the King and was burned as a heretic (1285). Consult: Meyer, *Tile Kolup* (Wetzlar, 1868), and Petri, "Der falsche Friedrich," in vol. ii. of *Zeitschrift des Bergeschen Geschichtsvereins* (Bonn, 1864).

HOMAGE (from OF. *homage, hommage*, Fr. *hommage*, Prov. *homenatge, homenage*, from ML. *hominaticum*, homage, from Lat. *homo*, man). In feudal law, the formal acknowledgment of the service which the vassal owed his lord. The form was ordinarily as follows: The vassal knelt before his lord, placed his hands between his lord's hands, and declared himself the lord's vassal for his fief. The lord then gave him a kiss and raised him from his knees. Homage and fealty (q.v.) were usually parts of the same ceremony, but were not synonymous. Consult Luchaire, *Manuel des institutions françaises* (Paris, 1892). See Feudalism.

HOMAGE ANCESTRAL. An ancient form of English land tenure of a privileged character. It was a form of the tenure of free and common socage (q.v.) and existed "where time out of mind a man and his ancestors had held by homage" only, in lieu of all other services. The alienation of an estate held by homage ancestral converted it into an ordinary socage tenure by homage, and freed it from the peculiar privileges which attached to it by virtue of its ancestral character.

HOM'ALONO'TUS (Neo-Lat., from Gk. *ὁμαλός, homalos*, level + *νῶτον, nōton*, back). A genus of fossil trilobites of large size, found in the Silurian and Devonian rocks, and characterized by the absence of trilobation of the thoracic segments. See Trilobita.

HOM'ALOP'SIDÆ. See Herpeton.

HOMAT'ROPINE (from Gk. *ὁμός, homos*, same + Eng. *atropine*, from Neo-Lat. *atropina*, from *Atropa*, deadly nightshade, from Gk. *Ἄτροπος, Atropos*, name of one of the Fates, the inflexible, from *α, a*, not + *τρόπος, tropos*, a turning, from *τρέπειν, trepein*, to turn). A by-product in the manufacture of atropine, used chiefly in preparing the eye for examination. For this purpose the hydrobromate, which is freely soluble in water, is employed. Its action is similar to that of atropine, but less powerful and less prolonged. The dilatation of the pupil passes off in from 24 to 36 hours, while that resulting from atropine lasts several days. Homatropine is often combined with cocaine when used for dilating the pupils. For internal use it is inferior to atropine.

HOMBURG VOR DER HÖHE, hōm'bōōrk fōr dĕr hē'e. A fashionable watering-place, largely frequented by English, in the Prussian Province of Hesse-Nassau, situated at the foot of the Taunus Mountains, 11 miles northwest of Frankfort (Map: Germany, C 3). It has an old castle which formerly belonged to the landgraves of Hesse-Homburg, and is now used by the Prussian royal family. The landgraves resided here from 1622 to 1866. The elaborate Kurhaus contains a museum of antiquities. The splendid gambling resort here was closed in 1872. The chief mineral spring is the Elisabeth-Brunnen, the water of which is very rich in salts, and is extensively exported. Other springs are rich in iron, and the waters of several of the springs are only used for bathing. The annual number of guests exceeds 12,000. Homburg has some manufactures of machinery and soap. Population, in 1900, 9635. The environs are delightful. Remarkable remains of extensive Roman intrenchments are to be seen in the vicinity.

HOME, Daniel Dunglas (1833-86). A Scotch spiritualist medium, born near Edinburgh. He was descended on his mother's side from a Highland family noted for its gift of 'second sight.' When a child he was brought to the United States, and before he was twenty he was widely known as a medium. On the testimony of William Cullen Bryant, Professor Wells of Harvard, and other well-known men, it is recorded that knocking on the walls, the sliding about of the furniture, and the 'levitation' of the medium himself in the air occurred without the slightest recourse to trickery so far as they could observe. When he returned to England in 1856, his séances were attended by many prominent people, including Robert Browning and his wife. Mrs. Browning is said to have believed in spiritualism, but her husband disbelieved, and was inspired to write *Mr. Sludge, the Medium.* In 1856 Home became a Catholic while at Rome; but in 1864 was expelled from the city as a sorcerer. Dr. Robert Chambers and Dr. Lockhart Robertson were among his converts, and a number of scientists were convinced of the genuineness of his powers, including Sir William Crookes, who published an account of the experiments made with him, entitled *Researches in the Phenomena of Spiritualism* (1874). In 1866 Home became secretary of the Spiritual Athenæum, for the propagation of spiritualism. He instituted a vigorous campaign against professional mediums and scrupulously abstained from taking money at his séances. He published *Incidents in My Life* (2 vols., 1863-72), and *Lights and Shadows of Spiritualism* (1877). Consult: Madame Home, *D. D. Home: His Life and Mission* (London, 1888), and *The Gift of D. D. Home* (ib., 1890).

HOME, Sir Everard (1756-1832). An English surgeon, born at Hull, the son of an army surgeon. He studied at Westminster School, and in 1773 resigned a scholarship in Trinity College, Cambridge, to study under John Hunter (q.v.), who married Home's sister. Home was long connected with the College of Surgeons, was its professor of anatomy and surgery, later master, and in 1821 its first president. It seems impossible to free Home from censure for burning Hunter's valuable manuscripts, of which he was custodian, or from the charge of using them in his work on *Comparative Anatomy* (1814-23), which gains what value it has from that fact. Among Home's other writings are: *The Properties of Pus*, which won a gold medal from the Lyceum Medicum Londinense (1788); a biographical notice of Hunter, prefixed to Hunter *On Blood, Inflammation, and Gunshot Wounds* (1794); *Practical Observations on the Treatment of Strictures in the Urethra and Œsophagus* (1795); *Observations on the Treatment of Ulcers on the Legs* (2d ed. 1801); *Practical Observations on the Diseases of the Prostate Gland* (1811-18); and *On the Formation of Tumors* (1830).

HOME, HENRY, Lord KAMES (1696-1782). A Scottish judge and author, born at Kames. He entered the bar in 1724, was raised to the bench in 1752, with the title of Lord Kames, and was made one of the lords of judiciary in 1763. As a coarse but able judge, he is mentioned by Scott in *Redgauntlet* (ch. i.). In 1728 he published *Remarkable Decisions of the Court of Session from 1716 to 1728*. The materials for this work were in 1741 embodied in his *Dictionary of the Decisions of the Court of Session* during its whole history. He is best known, however, by *Essays on the Principles of Morality and Natural Religion* (1751), containing a solution of the question of human freedom, which brought on him the suspicion of infidelity; *Introduction to the Art of Thinking* (1761); and, above all, the celebrated *Elements of Criticism* (1762), the work on which his fame now chiefly rests. In 1774 appeared his *Sketches of the History of Man*. While thus occupied with judicial and literary labors, he took a very active interest in agriculture, writing a useful tract entitled *The Gentleman Farmer, Being an Attempt to Improve Agriculture by Subjecting It to the Test of Rational Principles* (1776). His last work, *Loose Thoughts on Education* (1781), was written in his eighty-fifth year. Consult Lord Woodhouselee (A. F. Tytler), *Memoirs of the Life and Writings of Home* (Edinburgh, 1807).

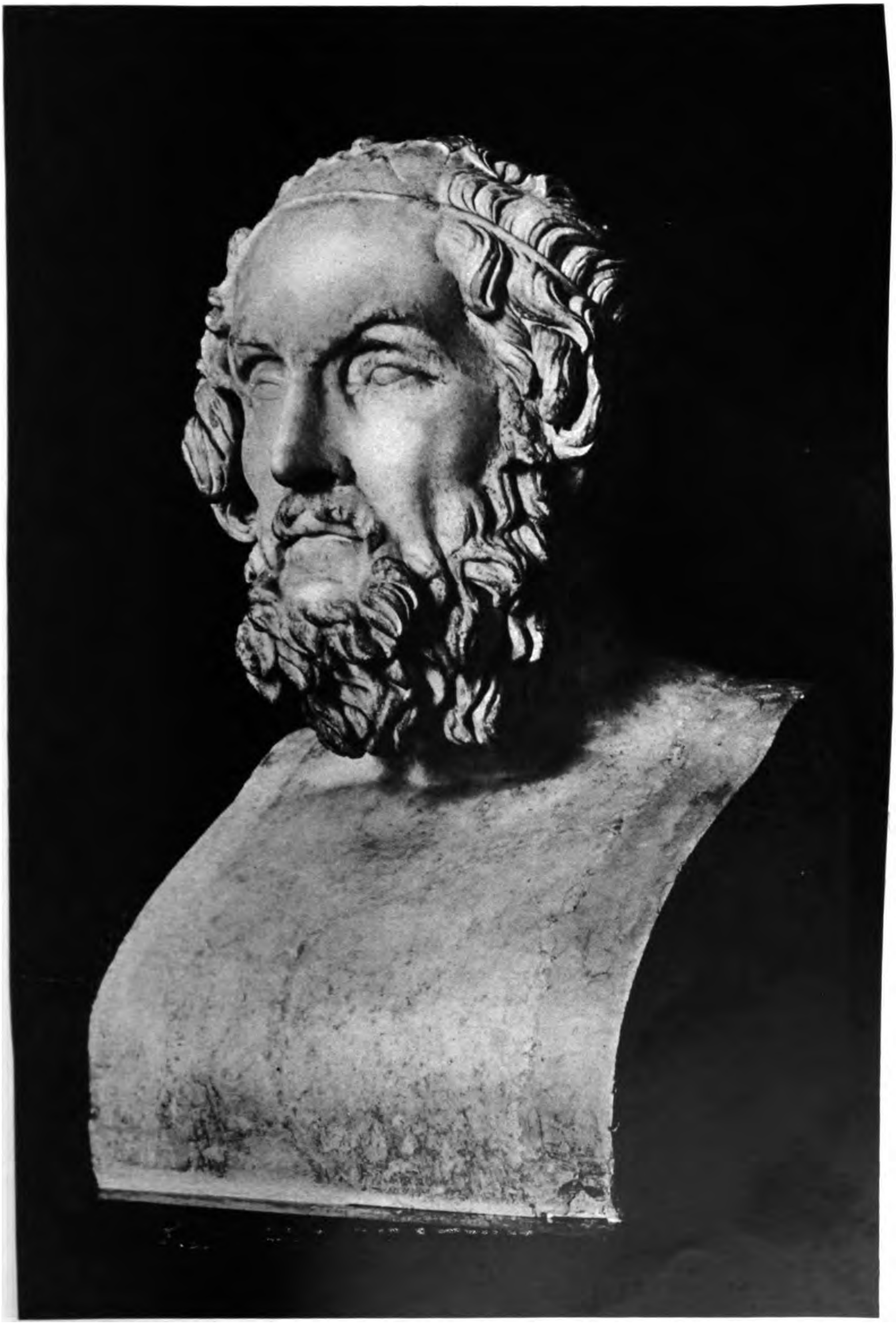
HOME, JOHN (1722-1808). A Scottish dramatist, born at Leith. He was educated at the University of Edinburgh, and prepared for the Church. During the uprising of 1745 he fought as volunteer on the Hanoverian side. In 1747 he became minister of Athelstaneford, in East Lothian, where he wrote his famous tragedy of *Douglas*. Performed at Edinburgh in 1756, and at London in 1757, it was received with enthusiasm. For his plot Home used the popular Scottish ballad of *Childe Maurice*, and in a less degree Shakespeare's *Othello*. The play, though turgid in diction, has great merits. It was the best English tragedy since Otway. The clergy of the Scottish Kirk, opposed to the theatre on principle, were scandalized by the production. After a bitter controversy Home resigned his charge (1757). He became secretary to Lord Bute, tutor to the Prince of Wales (afterwards George III.), and received liberal pensions. In 1770 he married and returned to East Lothian, and after a time settled in Edinburgh. Besides *Douglas*, Home wrote other plays, which either failed or met with moderate success. Among them are: *Agis*, *Aquileia*, *Fatal Discovery*, *Alonzo*, and *Alfred*. He also wrote a *History of the Rebellion of 1745*. Consult *Works*, with memoir by Henry Mackenzie (Edinburgh, 1822); and for *Douglas* alone, Wilson, *Poets and Poetry of Scotland* (London, 1875).

HOME AS FOUND. A novel by J. Fenimore Cooper (1838). It is a sequel to *Homeward Bound*, and, like it, is a criticism of American social conditions.

HO'MER. A city and the parish-seat of Claiborne Parish, La., 50 miles east by north of Shreveport; on the Louisiana and Northwest Railroad. It is the commercial centre for a productive cotton-growing district (Map: Louisiana, C 1). Population, in 1890, 1132; in 1900, 1157.

HOMER (Lat., from Gk. Ὅμηρος). A name for the early epic poetry of Greece. The less critical of the ancients attributed to Homer many minor poems, as the *Hymns*, the *Margites*, the late *Batrachomyomachia* (Battle of the Frogs and Mice), and many of the lost so-called Cyclic Epics, dealing with the early legends. To the more thoughtful he was the author of the *Iliad* and the *Odyssey*. The skeptical 'separators' (chorizontes) denied him the *Odyssey*. To us he is the unknown poet who chiefly shaped the *Iliad* and possibly the *Odyssey*. His date is placed by Herodotus about B.C. 850; by the moderns, anywhere from 900 to 1100. At any rate, he is the first name in European literature. The *Iliad* is an episode in the legendary siege of Troy, or Ilium, a real town of which Schliemann has excavated the remains at Hissarlik, a hillock in Northwestern Asia Minor. This siege is probably an idealization of the prolonged struggles of Achæan and Æolian invaders from Greece with the old (Phrygian?) possessors of the soil. In the legend it is undertaken to recover the beautiful Helen, wife of King Menelaus of Sparta, who had eloped with Paris, son of King Priam of Troy. In the tenth year of the war Achilles, the Achæan (Thessalian) hero, quarrels with the commander-in-chief, Agamemnon, King of Mycenæ, about a captive girl, Briseïs, and sulks in his tent, to the great loss of the Greeks, until aroused by the death of his dearest friend Patroclus. Then he hurls himself into the battle again and slays the slayer, Hector, the chief bulwark of Troy, with whose solemn burial the poem concludes.

The *Odyssey* relates, likewise in twenty-four books, the surprising experiences of Odysseus after the ten years' siege of Troy, wandering for ten years more, yearning to see the rocky isle of Ithaca. Underplots describe the life of his faithful wife, Penelope, persecuted by the importunate wooing of rude suitors, and the adventures of his son, Telemachus, who in the tenth year goes forth in search of his father. In the end, Odysseus returns, joins Telemachus, slays the suitors, and is at last recognized by Penelope. A literature does not thus begin with two long artistic and skillfully constructed epics. We must assume behind the *Iliad* shorter epic ballads such as the bard Phemius in the *Odyssey* chants to the suitors, and Demodocus recites at the Phæacian Court, hymns to the gods, and songs of the 'glory of men,' such as Achilles, idle in his tent, sings to the music of a lyre won from the spoils of a captive town. The systematic mythology of the poems, the number of



HOMER

FROM AN ANTIQUE BUST IN THE LOUVRE, PARIS

clearly defined personalities which they present, the profusion of detail about things and persons and places, their literary art, poetical diction, and mastery of the hexameter—all these things presuppose a long historical and literary development. But of this we know nothing except by analogy and inference from the poems themselves. The manifestly spurious ancient 'lives' are fictions, in many cases fashioned from minor poems attributed to 'Homer.' Homer, they tell us, was born of the nymph Critheis and the river Meles (at Smyrna), and hence called Melesigenes. The name 'Homer' was variously derived from the Greek word for hostage, because he was a hostage in youth, or from a dialectic word for blind, because he lost his sight. Homer, the 'Lives' continue, wandered from city to city of Asia Minor earning his bread by reciting his poetry or by 'teaching,' and immortalized by name in his poems many of those who treated him kindly. Some poems he actually gave to others who won fame by them—to Stasinus of Cyprus, e.g. he gave as his daughter's dowry the *Cypria*, one of the so-called Cyclic Epics, of which only a few fragments remain. He died, as an oracle had foretold, through chagrin at his inability to read the riddle of the fishermen: "What we caught we left, what we caught not we bring," which referred not to fishes, but to an animal more 'familiar to man.' After his death, "Seven cities claimed the mighty Homer dead, where living Homer begged his daily bread."

All this and much more is fable. Modern scholars ask, rather: What is the origin of epic poetry in Greece? Can we detect in the *Iliad* traces of the ballads or shorter lays out of which we may conceive it to have been composed? Can we break up the *Iliad* into two chief groups of lays—the wrath of Achilles proper, and the general picture of the siege of Troy, by which this original framework was enlarged? What features of style, language, and manners mark the *Odyssey* as later than the *Iliad?* What parts of the *Iliad* most resemble the *Odyssey* in these features? Can we dissect the *Odyssey* into a 'return of Odysseus' and a 'Telemachiad'? Was the 'story of Achilles' originally composed in Thessaly in the Æolic dialect, then transferred to the scene of the struggles of early Greek colonists in Northwestern Asia Minor, and finally Ionicized, enlarged, embellished, and chanted by minstrels in the halls of Ionian nobles and merchant princes on the Lydian coast? Does the *Odyssey* reflect the travelers' tales brought back to Ionian seaports by the first navigators of the Euxine and the Mediterranean? What is the precise relation of the life depicted by Homer to the traditional legend of early Greek history on the one hand, and on the other to the apparently similar civilization revealed at Troy, Mycenæ, and Tiryns by the spade of Schliemann, and conjecturally carried back to the third millennium B.C. by recent discoveries in Crete?

These questions are debated by specialists, but with little unanimity of result. Meanwhile the *Iliad* and the *Odyssey* abide. They may be studied: (1) As a picture of early Greek life; (2) as literature; (3) in their historic influence.

Homer is the most objective of poets. In him mind has not yet been turned back upon itself. It is a mirror of the world. If the heroes dine, the ox is consecrated to the gods, slain, cut up, roasted, carved, and served up in our presence. We assist at all the details of the hero's toilet, or of his arming for battle. Homer does not enumerate the parts of a ship or a bed; but he shows us Odysseus building the craft that is to bear him away from the isle of Calypso, or the bed whose secret reveals his identity to Penelope. We watch every step in the launching of the vessel that bears Chryseïs back to her father. We are not merely told that the ox sacrificed by Nestor has gold-tipped horns; we see the goldsmith come with the tools of his craft to lay on the gold. In consequence, we know the life of the Homeric man more intimately than that of any other primitive people—than that of the Hebrews or of our own Teutonic ancestors. This lore has been collected in three huge double volumes of Homeric 'Realien,' or real things, by the German Buchholz, and every history of Greece contains its chapter on early Greek life, religion, government, and manners, drawn from the same source. And this wealth of concrete detail is a striking, if not the chief, literary quality of Homeric poetry. Homer does not "beat in the void his luminous wings in vain." He does not analyze and refine. He is not dominated by any one great unifying religious or patriotic idea, like Vergil or Dante or Milton. He does not delay to moralize or reflect except in brief pregnant sentences. He flows on and on in a broad, pellucid stream of narrative, description, and, above all, action. "The multitude of things in Homer is wonderful" (says Hazlitt)—"the splendor, the truth, the power, the variety." The great gods of Homer—Zeus, Apollo, Athena, Hera, Poseidon—have remained for 3000 years as ideal types for all subsequent poetry and sculpture. His personages—Achilles, Hector, Nestor, Odysseus, Helen, Andromache, Penelope, Nausicaa—live for the imagination to-day as no others save those of Shakespeare's greatest tragedies. The berserker battle rage and impassioned eloquence of Achilles still stir the sluggish blood like wine. The great pathetic or dramatic episodes—the parting of Hector and Andromache, the death of Sarpedon, the horses of Achilles mourning for Patroclus, Hecuba baring her bosom to her son from the walls of Troy, the dirges for Hector—are still the despair of imitators. The *Odyssey* is yet the most interesting story-book in the world. In short, the Homeric poems are still, as Matthew Arnold said, "the most important poetical monument existing." The most distinctive literary quality of that poetry is due to its intermediate position between the literary epic, as *Paradise Lost*, and the supposedly spontaneous popular epic, as the *Edda*, the *Kalewala*, or the *Chanson de Roland.* It has all the simple, childlike charm of the one, all the lucidity, architectonic order, and noble diction of the other. The primitive feelings still preserve their freshness and force, but they appeal to us through the medium of a noble and dignified art. But though an artist, and perhaps a conscious artist, the Homeric poet is not like his successors, Apollonius of Rhodes, Vergil, Tasso, Milton, conscious of an inimitable model, of a long line of predecessors, and of a code of critic-formed rules. Matthew Arnold's four canons of Homeric style are well known: Homer, he says, is rapid, plain, and direct in syntax and words, plain and direct in matter and ideas, and yet withal eminently noble—a master of the grand style in simplicity. There is space only to mention some minor traits:

(1) The stereotyped epithets, 'cloud-compelling Zeus,' the 'wine-dark' or 'unharvested' sea, the 'rosy-fingered dawn,' 'the swift-footed Achilles,' the 'red-cheeked ships;' (2) the peculiar Homeric simile which, suggested by one point of resemblance, is continued for the sake of the picture into details where the likeness ceases. It is cleverly imitated by Matthew Arnold in *Sohrab and Rustum.* There are nearly 200 such similes in the *Iliad,* many of them containing precious detail about Homeric life. Those drawn from lions and the chase are particularly vigorous. To the Greek, Homer was Bible, Shakespeare, Milton, and Domesday Book in one. Later forms of poetry were looked upon as evolutions or borrowings from Homer. He was the foundation of education, and many cultivated Greeks knew the *Iliad* by heart. Even in the prime of the Attic drama professional rhapsodists recited the *Iliad* and *Odyssey* to enthusiastic audiences of thousands. Ethical reflection took its first texts from Homer, and was largely occupied in the criticism of the conduct and character of his personages. Purer religious ideas presented themselves in the form of a censure by Plato and Xenophanes of Homeric anthropomorphism, and the allegorical interpretation of literature was invented as a reconciliation. The first beginnings of literary and linguistic criticism among the Greek sophists attached themselves to Homeric problems. Lexicography probably originated in books of Homeric glosses. The conception of text criticism arose in the effort to establish a sound Homeric text. And the critical science of the great Alexandrian scholars, Zenodotus, Aristophanes of Byzantium, and Aristarchus, had its origin and achieved its greatest triumphs in the study of Homer.

It is in the modern world that the famous Homeric Question begins, if we ignore slight anticipations by Bentley and Vico, with Wolf's Latin *Prolegomena,* published in 1795. This was partly called forth by the recent publication of the Venetian scholia, which revealed how much the true text had been debated by the critics of antiquity. Wolf also collected stray notices in ancient authors to the effect that Solon or Hipparchus required the rhapsodists to recite Homer in due succession or from prompting, and that Pisistratus first reduced the scattered poems of Homer into one body. He inferred that the *Iliad* and the *Odyssey* were not originally composed as we have them, but were put together out of preexisting materials. He confirmed this view by the argument (now refuted by facts) that writing was unknown, or at least rare, in early Greece, and that a long epic could not have been composed without writing. Since Wolf's time, Lachmann, Hermann, Nitzsch, Grote, Christ, and a host of others have elaborated theories of the composition of the *Iliad.* The debate between the partisans of lays stitched together and an original framework expanded and interpolated often degenerated into a logomachy. The tendency now is toward the second hypothesis. Proof is in the nature of things unattainable.

The imitation of Homer through Vergil by Tasso, Camões, and Milton is too large a theme for our space. The critics of the seventeenth and eighteenth centuries elaborated rules for the correct epic which have been entertainingly parodied by Macaulay in his prophetic account of the 'Wellingtoniad.' Pope's translation (about 1720) long remained a classic and the model of poetical diction. It of course failed to satisfy the taste of the romantic revival at the end of the century, or to meet the demands of the new scholarship born about the same time in Germany. Many attempts have been made to supersede it in popular favor; but, despite its artificial rhetoric, it still remains for the majority of English-speaking readers the one poetical translation of Homer. The early versions of Hobbes and Ogilby are of interest only to professional students of literature. Chapman is praised on the faith of Keats's noble sonnet, and because of occasional spirited passages and exquisite lines. But the rugged rhythms, the obscurity of the syntax, the fantastic Elizabethan conceits, and the long uninspired tracts of doggerel make him intolerable in continuous perusal. Cowper, in his blank-verse version, aimed at uniting Miltonic stateliness with fidelity to Homeric simplicity, but succeeded only in being pompous and dull. Since the publication of Matthew Arnold's classic lectures *On Translating Homer,* we have had, among others, the estimable blank-verse translations of Lord Derby and of Bryant, and Way's spirited rendering in rhymed anapæstic hexameter. No definitive translation of Homer is possible, for every generation must reinterpret him in order to blend Homeric sentiment with its own in the measure demanded by its taste. Of late the majority of readers prefer the literal prose versions in the slightly archaic and consciously simple English of Lang, Leaf, and Myers (*Iliad*), and Butcher and Lang (*Odyssey*).

Bibliography. The needs of the English student will be best met by Jebb, *Introduction to Homer* (Glasgow, 1887); Lang, *Homer and the Epic* (London, 1893); Seymour, *Introduction to the Language and Verse of Homer* (Boston, 1889); and Monro, *Homeric Grammar* (Oxford, 1891).

Good text editions are those of Dindorf-Hentze and Cauer. A good annotated (English) edition of the *Iliad* is that of Leaf (London, 1888), and of the *Odyssey* that of Hayman (London, 1882). The fullest Homeric lexicon is the *Lexicon Homericum* of Ebeling (Leipzig, 1885), or in English the Homeric Dictionary, by Keep-Autenrieth (New York, 1891). For the general study of Homeric antiquities, consult: Buchholz, *Homerische Realien* (2d ed., 3 vols., Leipzig, 1887); Helbig, *Das Homerische Epos* (Leipzig, 1887); and Anderson-Engelmann, *Pictorial Atlas to Homer* (New York, 1892). See Epic Poetry; Greek Literature.

HOMER, Apotheosis of. A celebrated relief containing many figures, now in the British Museum. It was found in the Appian Way in the seventeenth century, and probably dates from the first century A.D.

HOMER, Winslow (1836—). An American painter, born in Boston. He had been in a lithographer's shop in Cambridge, and contributed sketches to magazines, before he became a pupil in the National Academy of Design, at the same time taking lessons from Frederic Rondel. During the Civil War he was special artist for *Harper's Weekly.* He went to New York in 1859, and in 1864 exhibited his first large picture, "Prisoners from the Front." The following year he was made an academician. Afterwards he settled in Scarboro, Maine. Between the years 1864 and 1884 he produced a number of genre subjects, usually taken from American life, such as "Home, Sweet Home," "Cotton Pickers," "In the Field," and "A Visit from the Old Mistress." All these show his independent realism and vigorous individuality. He began his sea pictures with the "Life Line" (1884). The series includes: "Eight Bells," "Danger," "Launching the Boat," "The Tempest," "The Peril of the Sea," and "The Lookout" (1897). They are all essentially dramatic studies of sturdy fisher-folk and 'longshoremen, and prepared the way for the purely marine pictures which he did later. Among these are: "A North Easter," "The Gulf Stream," and, particularly, "The Maine Coast," a magnificent marine of stormy skies, black rocks, and driving spray, which is his masterpiece. The strong color and broad, virile workmanship in Homer's pictures attracted much attention at the Paris Exposition of 1900. He is also an admirable painter in water-color.

HOMERIDES, hō-mĕr′ĭ-dēz, or **HOMERIDÆ** (Lat., from Gk. 'Ομηρίδης, *Homērídēs*, descendant of Homer, from Ὅμηρος, *Homēros*, Homer). The name of a family or clan in the island of Chios, often mentioned; Strabo says that they claimed descent from Homer, and were adduced by the Chians to prove that Homer himself was a Chian. The name Homeridæ, however, is used by Pindar and by others frequently to mean persons who recite the Homeric poems, i.e. rhapsodists; and it is in this sense that the name is commonly used. The Homeridæ of Chios have played a large part in the theories of some scholars as to the transmission of the Homeric poems; but there is no evidence that they were a guild of poets or even of rhapsodists.

HOMER PIGEON. A pigeon trained to long-distance flying and used to carry messages.

HOME RULE. A term in British politics, designating the particular movement, begun in 1870, to secure for Ireland a local legislature, and thus recognize and satisfy the persistent sentiment of Irish nationality. The question of Home Rule, ignored by Pitt in the Act of Union of 1800, was revived by O'Connell's agitation for repeal. With the failure in 1848 of that movement, hostility to British rule passed from the field of constitutional exertion to that of violence and revolution. But neither the doctrinaire fiasco of 1848 nor the plots of the Fenians brought any realization of the national aspirations. After twenty troubled years of conspiracy and secret crime, the concession by Gladstone of Church disestablishment and land reform called the thoughts and hopes of the Irish people once more to constitutional activity. In 1870, a year after the Act of Disestablishment was passed, and while Gladstone's first Land Bill was still under discussion in Parliament, the first step was taken in the movement for Home Rule.

On May 19th in that year, there assembled at the Bilton Hotel, Dublin, a number of Irishmen of the better class, representing all shades of political and religious belief. The dominant element was Protestant and Conservative. Discontented with the concessions made by Gladstone's Government, they were ready to consider some plan for taking out of British hands the control of Irish affairs. After free discussion, it was resolved "that the true remedy for the evils of Ireland is the establishment of an Irish Parliament, with full control over our domestic affairs." In accordance with this opinion, a permanent organization was soon afterwards effected, under the name of 'The Home Government Association of Ireland.' Its declaration of principles announced as its only object the obtaining of a distinct Parliament for Ireland, to regulate her internal affairs, while leaving to the Imperial Parliament all questions affecting the colonies, foreign relations, and the stability and defense of the Empire. With this declaration the movement for Home Rule was formally inaugurated.

The history of the Home Rule movement from 1870 to the present time may be divided into four periods: First, the leadership of Isaac Butt (1870-79); second, the merging of Home Rule into the land agitation (1879-86); third, the adoption of the principles by the Gladstonian Liberals (1886-93); and fourth, the Conservative policy of 'killing Home Rule by kindness.'

First Period. This was the time of development and definition. From the outset the Home Rule idea was favorably received among the better classes of the Irish people, though ancient religious antipathies often blocked the way. Among the lower classes—those particularly in which Fenianism had found its chief support—the new form of constitutional agitation was slow to inspire confidence. Under the direction of Isaac Butt, however, who had made himself popular by his legal services in behalf of arrested Fenians, considerable progress was made, and at bye-elections several Home Rulers, including Butt himself, were elected to Parliament. In the fall of 1873 the Home Government Association was replaced by the Irish Home Rule League, a new and more comprehensive organization, whose skillful management secured the return of sixty Home Rulers in the general election of 1874. For the next five years, under the leadership of Isaac Butt, they acted as a distinct party when Home Rule or Irish interests were at stake, but on other questions followed their individual preferences. In fact, during this period, outside of Ireland, there was very little interest in the subject, and English Liberal and English Conservative alike had voted against Butt's annual motion for an Irish Parliament. But an awakening was to come, when Parnell, who entered the Commons in 1875, began to advocate his policy of 'obstruction,' applying it—aided by a little group of followers—to all questions alike, whether Irish, English, or Imperial. In this course he was opposed by Butt and the majority of the party at that time; but through this policy Parnell succeeded in arousing the English people to a discussion of the subject, and in winning, partly perhaps by means of the hatred he excited toward himself on the part of the old British parties, the enthusiastic support of Irishmen to a degree which Butt's milder course had never done.

Second Period. Butt died in the spring of 1879. The Home Rule Party chose as his successor William Shaw, whose methods it was known would be those of Butt. But Parnell was the rising man in Irish circles. In this same year, by throwing himself heart and soul into the land agitation, and assuming the presidency of the Land League, he became the idol of the Irish masses. During the four succeeding years Home Rule was entirely overshadowed by the great agrarian issue. The general elections of 1880 showed an increase of the Home Rule delegation in Parliament from 60 to 68. But the extreme views of Parnell and his followers on the land question tended to alienate the moderate element in the party, already disgusted with his Parliamentary tactics. During the desperate struggle made by the Parnellites against the Coercion Bill in January, 1881, Shaw and his followers formally withdrew from the Home Rule Party in Parliament. This action was significant of a great change in the character of the party outside of Parliament. By connecting Home Rule with the land question, Parnell drew to his support a great following which Butt had never won; but he lost the Conservative and aristocratic element, which had practically inaugurated the movement. A Catholic peasantry instead of a Protestant middle class became the chief support of the party. With this absorption of the larger element one end was achieved which has been a source of about equal glory and reproach to Parnell—the physical-force faction, hitherto apathetic, was drawn into the constitutional agitation. The Irish National League, organized October 17, 1882, was the formal expression of the Parnellite policy. Its programme combined essentially the principles of the Home Rule League and those of the recently suppressed Land League. In the elections of 1885 the success of Parnellism was demonstrated. The Nationalists returned 86 members to the House of Commons, and secured the balance of power between the Liberals (333) and the Conservatives (251). Of the 103 members from Ireland, 85 were followers of Parnell.

Third Period. With an absolute Liberal majority in Parliament, so skillful a leader as Gladstone had found it almost impossible to transact business in the face of Nationalist obstruction. Now that Parnell held the balance of power, and could displace Ministries at will, the conduct of the Government on any principle known to British practice seemed hopeless. On January 27, 1886, the Nationalists aided the Liberals to overthrow Lord Salisbury's Government, just as in the preceding year they had joined the Conservatives against Mr. Gladstone. The Conservatives now made advances looking to an understanding between the Nationalists and themselves, but without results. On the other hand, Gladstone, after careful consideration and consultation, decided to accept Home Rule as a Liberal principle, so on the 6th of April he brought in his famous Home Rule Bill. In it was embodied the long-sought provision for a distinct legislative body for Ireland, with powers extending to all subjects except those specifically reserved to the Parliament at Westminster. At the same time a sweeping measure for land purchase was announced, with the declaration that the two should be inseparable, together forming a complete scheme for the settlement of the Irish question. Parnell, with certain qualifications, accepted the bill on the part of the Irish Nationalists, and his party threw themselves heartily into alliance with the followers of Gladstone. The question of Home Rule now became one for the people of Great Britain to settle. With the adoption of the Irish demand by Gladstone, a great section of the Liberals declined to follow their old leader. Protesting against anything which looked like a step toward separation of the two islands, they took the name of Liberal Unionists, and ultimately entered into alliance with the Conservatives. Gladstone's bill was defeated on the second reading by 343 to 313, 93 Liberals voting in the negative. Upon the appeal to the constituencies, the adversaries of Home Rule gained a majority of 113 over the combined Gladstonians and Nationalists. Lord Salisbury assumed power with a policy of coercion, with possibly some eventual measure of concession in reference to local government in Ireland. Home Rule remained the most prominent issue throughout the four succeeding years, the Gladstonians expressing confidence in the ultimate support of a British majority, a belief which the bye-elections seemed to justify, as the Liberals gained 16 seats in 99 contests. In the winter of 1890-91 a divorce case in which Parnell was corespondent brought much odium upon him, and raised the question of his retirement from the leadership of his party. Gladstone announced that he could not hope to hold the Liberals to the Nationalist alliance unless Parnell resigned. The latter rejected all suggestions of his own withdrawal, and by his course alienated a large section of his Parliamentary followers. The result was a schism in the Irish Nationalist Party, which made the future success of the Home Rule movement exceedingly doubtful. The death of Parnell, in October, 1891, only served for the moment to intensify the animosity of the Parnellite faction toward the majority of the Home Rulers, who accepted the leadership of Justin McCarthy (q.v.). The elections of July, 1892, resulted in a Liberal majority in the House of Commons of 40, so that Gladstone again became Premier, and in March, 1893, introduced a bill granting Home Rule to Ireland. It provided for an Irish legislative body of two houses, the members of the Upper House to be chosen by electors having a property qualification, and for complete self-government in local matters. The difficult question of Ireland's representation in the Imperial Parliament was first decided in favor of the 'in-and-out' plan—Irish members voting on some questions, not on others—but later in favor of a reduction of its membership in the House of Commons from 103 to 80, giving them the same rights as to other members. The bill passed the Commons September 1st (301 to 267), but was overwhelmingly defeated in the Lords, receiving only 41 votes out of a total of 450. Gladstone resigned in March, 1894, and Lord Rosebery assumed the Premiership, professing adherence to Home Rule, but doing nothing for it during his Ministry, which came to an end in June, 1895.

Fourth Period. This period opened with the Conservatives in power, the Home Rulers split into cliques and factions, and the Liberals demoralized and lukewarm toward the cause of the Irish Nationalists. The Conservatives, believing that Irish discontent had its source in economic conditions, in poverty and want, passed, under the cry of 'killing Home Rule by kindness,' a land act which simplified the rent problem, provided for land purchase, tended to bring a peasant proprietor class into being, and in general ameliorated economic conditions. In 1898 a Local Government Bill was introduced, and became a law in 1899, which placed county and municipal governments in the hands of the people, with provisions for an almost universal suffrage. In part due to improved conditions, in part due to these reforms, public agitation had almost ceased, and it seemed as if 'Balfourian amelioration' was on the point of success, when the Boer War broke out. Under the impulse of this war, the warring Irish factions came together, accepted John E. Redmond as a common leader, revived their demand for an Irish Parliament, and in the election of 1900 chose 81 members to the House of Commons to press their cause. Believing that the Local Government Act had already proved the capacity of the Irish people for self-government, asserting that the British Parliament had too much to do to do it well, and insisting on the justness of their cause, Redmond and his 80 followers intend to block legislation whenever they can and whenever it will benefit their cause, until the British people and Parliament are forced to accede to Ireland's demand for Home Rule.

The literature on Home Rule in Ireland is very extensive, and only a few of the best works can be mentioned: McCarthy, *The Case for Home Rule* (London, 1887); O'Brien, *Irish Wrongs and English Remedies* (London, 1887); Chamberlain, *Home Rule and the Irish Question*, speeches, 1881-85 (London, 1887); Dicey, *England's Case Against Home Rule* (London, 1887); Gladstone and others, *Handbook of Home Rule, Being Articles on the Irish Question* (London, 1887); Hurlburt, *Ireland Under Coercion* (2 vols., Boston, 1888); the London *Times*, *Report of the Proceedings of the Special Committee* (4 vols., London, 1890); Gladstone, *Special Aspects of the Irish Question* (London, 1892); Lloyd, *Ireland Under the Land League* (London, 1892); and Pollock, "Home Rule and Imperial Sovereignty," published in *Oxford Lectures and Other Discourses* (London, 1890). There is also an almost unlimited amount of magazine literature.

HOMESPUN, Zekiel and Cicely. A brother and sister, in Colman the Younger's comedy *The Heir at Law*. They are simple country people, showing the best traits of their class.

HOMESTEAD (*home*, AS. *hām*, Goth. *haims*, OHG. *heim*, Ger. *Heim;* connected with Lith. *kemas*, Gk. *κώμη*, *kōmē*, village, Skt. *kṣēma*, abode, from *kṣi*, to dwell + *stead*, AS. *stede*, Goth. *staþs*, OHG. *stat*, Ger. *Statt*, place; ultimately connected with Eng. *stand*). In law, an estate in land, used as a home by the tenant or owner thereof, and to a greater or less extent protected by law from the claims of creditors. This right of exemption of the 'homesteader,' as he is termed, is a modern privilege created by statute and was unknown to the common law. It does not exist in England, but is peculiar to the United States, where it is everywhere recognized, excepting in Rhode Island, Pennsylvania, Delaware, Maryland, and the District of Columbia. It does not constitute a distinct form of estate in land, but belongs to the class of exemptions from the claims of creditors, which, originating in the common law, has been greatly extended by the humane policy of American law. See Exemption.

HOMESTEAD. A borough in Allegheny County, Pa., eight miles southeast of Pittsburg; on the Monongahela River, and on the Pennsylvania and the Pittsburg and Lake Erie railroads (Map: Pennsylvania, B 3). It has one of the largest steel plants in the United States, employing about 6000 men, and producing both structural steel and nickel-steel armor plate. There is a Carnegie library. Settled in 1871, Homestead was incorporated in 1880, the date of the charter now in operation, which provides for a mayor, elected every three years, and a unicameral council, in whose power rests the appointment of chief of police, street commissioner, and water-works engineer. The waterworks are owned and operated by the borough. In 1892 Homestead was the scene of a notable strike, which was attended by such rioting as necessitated the interference of State troops. Population, in 1890, 7911; in 1900, 12,554.

HOMESTEAD LAWS. Homestead laws are of two classes: those enacted by Congress and those enacted by State Legislatures. The primary object of the first class is to enable citizens without capital to acquire homes. The main object of the second class is to secure homes, once acquired, against the claims of creditors. Legislation of the first class has done much to stimulate the settlement and improvement of wild, unoccupied land. That of the second class has saved countless families from pauperism.

The Federal homestead laws begin with the Act of 1862, now a part of the United States Revised Statutes (§§2289-2317). Their policy is to give portions of the public lands to those who will settle, cultivate, and make permanent homes upon them. Any person who is the head of a family, or who is twenty-one years of age and is a citizen of the United States, or who has filed his declaration of intention to become such, may acquire a tract of unappropriated public land, not exceeding one hundred and sixty acres, on condition of settlement, cultivation, and continuous occupancy as a home by him for the period of five years, and of the payment of certain moderate fees. It is expressly declared that no lands acquired under this statute shall in any event become liable to the satisfaction of any debt contracted prior to the issuing of the patent therefor by the Government to the settler. This provision was inserted for the purpose of protecting debtors and of inducing them to settle upon the public domain. Its constitutionality was questioned, but was sustained by the courts. It would be difficult to point to any enactment of Congress more wise in conception, just in policy, and beneficial in its results than this homestead statute and its amendments. Under their provisions, more than 65,000,000 acres of unoccupied public lands have been transferred by the United States to homestead settlers. During the fiscal year ending June 30, 1901, the Commissioner of the General Land Office reports that "the original homestead entries, final homestead entries, and commuted homestead entries aggregated 111,390, and embraced 15,455,057.46 acres for actual *bona fide* homes to American settlers."

The term 'original entry' refers to the proceeding by which a person enters a tract of land as his homestead. Its important features are the filing of an affidavit, prescribed by statute, with the register of the land office in which he is about to make the entry, and the payment of a fee of five dollars if his entry is for not more than eighty acres, or of ten dollars if it is for more than that amount. The 'final entry' refers to the proceedings connected with the issue of a certificate of title or patent by the United States to the person making the original entry, or to his widow, heirs, or devisees. Ordinarily the patent does not issue until the expiration of five years from the date of the original entry, and then only upon furnishing the evidence required by statute of the actual occupancy of the land and its cultivation by the claimant during that period. Provision is made, however, for shortening this term by 'commuting,' that is, paying the minimum Government price for the land. Upon such payment, the homesteader may obtain a patent at any time. It is also provided that the term which a homestead settler served in the United States Army, Navy, or Marine Corps, "during the Rebellion," or in "the Spanish War," or "in suppressing the insurrection in the Philippines" may be deducted from the five years required to perfect his title and to receive a patent for his original entry.

Passing now to State homestead laws, we shall find, as we have already stated, that their object and tenor are quite different from those of the Federal Government. Their aim, it has been judicially declared, "is to provide a place for the family and its surviving members, where they may reside and enjoy the comforts of a home, freed from any anxiety that it may be taken from them against their will, either by reason of their own necessity or improvidence, or from the importunity of their creditors." This policy of protecting citizens and their families from the miseries and demoralizing influences of destitution, of fostering the disposition to improve and to take pride in a permanent homestead, has commended itself to both legislators and judges. The former have enacted laws providing for large exemptions to the homesteader, while the latter have, with few exceptions, construed such laws very liberally in his favor. In most of the States, the benefits of this legislation are confined to families, although in a few commonwealths they are extended to any resident, whether he has a family dependent upon him or not.

State legislation provides three distinct ways in which a homestead may be secured to the family against the debts of its owner. The first method is by a prescribed form of public notice properly executed and recorded. It must contain a statement of the facts showing that the person making it is the head of a family; a statement that such person resides on the land and claims it as a homestead; a description of the land, and an estimate of its actual cash value. The second method is by actual occupancy and use. The third method is by a proceeding in a court of justice. Its principal characteristics are an application to a designated court, a notice to creditors, and a judicial decree setting apart certain property as a homestead.

It is not to be understood that homestead property is exempted from every sort of claim against its owner. As a rule it is subject to debts contracted before the homestead was duly recorded or set apart as such; to the liens of mortgages and judgments which were on the property when it was set apart; to claims for unpaid purchase money for the property, as well as for such improvements to the property as entitle the creditor to a mechanic's lien (q.v.) thereon; and to taxes and assessments for public improvements.

The amount of land which may be exempted under homestead laws varies in the different States. In some the limits are those of acreage, in others those of cash value. The former range ordinarily from 40 to 160 acres; the latter from $500 to $5000. Consult: Thompson, *Homesteads and Exemptions* (San Francisco, 1886); Waples, *Homesteads and Exemptions* (Chicago, 1892).

HOME, SWEET HOME. A popular song by John Howard Payne, in his opera, *Clari, or the Maid of Milan*, first produced in 1823. The music of the song is by the composer of the opera, Sir Henry Bishop, who is said to have adapted it from an old Sicilian air.

HOMEWARD BOUND. A novel by J. Fenimore Cooper (1838). It relates the adventures of passengers on the packet *Montauk*, which was blown out of her course to the coast of Africa.

HOMICIDAL MANIA. The impulse to take life in one mentally disordered. In melancholia, in mania, in general paresis, in paranoia, and other insane conditions, the homicidal impulse is not infrequent. Indeed, in normal mental action the desire to kill is not infrequently present, but is controlled. In the various stages of insanity this control is either diminished, or through hallucinations or delusions, the motive is stronger and uncontrollable, and murder results. It is impossible to determine beforehand whether an insane person will or will not take another's life. Often such an act is apparently the first symptom of the insanity. It is fruitless to generalize concerning such acts; the obvious lesson is that the slightest symptoms of disturbed mental action should be carefully noted and proper precautions taken to prevent accidents. This caution is particularly pertinent in the case of puerperal women in whose family there has been any taint of insanity.

HOMICIDE (OF., Fr. *homicide*, from Lat. *homicidium*, manslaughter, from *homo*, man + *cædere*, to kill). The killing of one human being by the act, procurement, or omission of another. In primitive communities, we find that it does not subject the slayer to criminal prosecution by the State. It is thought of, not as an offense against the common weal, but simply as a wrong to the slain man's kindred; a wrong which they are at liberty to redress by vengeance upon the slayer or his kindred. But this policy leads to the perpetuation of blood feuds and to great waste of human life. Accordingly, at a very early time, the practice is introduced of buying off the injured kindred; of appeasing the feud by a money payment. Then a scale of compensation is fixed either by custom or by legislation, graduated generally by the rank of the person slain. In Anglo-Saxon law this is known as *wergild*—a man's price. At first the acceptance of such compensation is left to the choice of the injured kindred. They may take it and stay the feud, or they may reject it and enforce their right of private vengeance. But as the State grows more powerful, and the death of its citizens is felt to be a harm to the common weal, public authority compels the injured kindred to accept the compensation and not to pursue the feud. Then comes the final stage of legal development, in which the unlawful taking of human life is considered as primarily a wrong to the State, a public offense which cannot be compounded by private bargain. See AVENGER OF BLOOD; BLOOD FEUD; BLOOD-MONEY; ASYLUM; WERGILD; etc.

Homicide is a generic term, including the crimes of manslaughter (q.v.) and murder (q.v.), as well as the non-criminal forms of killing known as excusable and justifiable homicide. This article will be confined to the two latter species. By the early common law an important distinction was made between excusable and justifiable homicide. The slayer in the latter case was not liable to any punishment, while in the former he was. In other words, excusable homicide was not legally excusable. Just how far it subjected the slayer to criminal punishment is uncertain. Lord Coke declares that it rendered him liable to death, but Blackstone and Stephen insist that his liability did not extend beyond the forfeiture of goods. At present neither excusable homicide nor justifiable homicide is punishable at all, but the two terms are still retained in use in England and in many of our States. The signification of each, however, has been varied by modern legislation from the common-law meaning. At common law excusable homicide was of two kinds: killing by accident or misfortune, and killing in self-defense. At common law, justifiable homicide was of three kinds: killing by a public officer in conformity to a judicial sentence; killing by an officer or his assistant when necessary to overcome unlawful resistance to legal process, or to the performance of a legal duty, including killing by military forces in time of war or riot; and killing to prevent the commission of an atrocious crime.

Homicide is not wholly excusable unless it is committed without legal fault on the part of the slayer. The killing may not have been planned or thought of—it may have been accidental—yet if it resulted from the slayer's unlawful conduct, it is not a case of excusable homicide, but of manslaughter or murder, as the case may be. So, too, homicide is justifiable only when it is inflicted in strict accordance with lawful authority. A sheriff who inflicts the death penalty upon a convict in a manner not authorized by the judicial sentence which he undertakes to execute does a criminal, not a justifiable, act. An officer cannot justify the unnecessary killing of even the worst malefactor that is resisting arrest. Nor is a person at liberty to take the life of a brutal assailant unless he can show that he had reasonable ground to believe that the assailant was about to commit a felony or do some great personal injury to the slayer or to some member of his family or other person in his presence, and that there was imminent danger of the assailant's accomplishing his design.

Consult: Stephen, *History of the Criminal Law of England* (London, 1883); Clark and Marshall, *Law of Crimes* (Saint Paul, 1900); and the authorities referred to under CRIMINAL LAW.

HOMILDON, hŏm'ĭl-don, or **HUMBLEDON** (hŭm'b'l-doṇ) **HILL**. An elevation near Wooler, in Northumberland, England, not far from the Scottish border, noted as the scene of a battle in which the English, under the Earl of Northumberland and his son, Harry Hotspur, overthrew a Scottish army under the command of Sir Murdoch Stewart and the Earl of Douglas, September 14, 1402. The victory at Homildon Hill was soon followed by the rebellion of the Earl of Northumberland and his son. See HENRY IV.

HOM'ILET'ICS (from Gk. *ὁμιλητικός*, *homilētikos*, relating to conversation, from *ὁμιλία*, *homilia*, conversation, from *ὁμιλεῖν*, *homilein*, to converse, from *ὅμιλος*, *homilos*, assembly, from *ὁμός*, *homos*, similar + *ἴλη*, *ilē*, *εἴλη*, *eilē*, company, from *εἴλειν*, *eilein*, to crowd together). As the term is now used, the science of sermon-writing. Originally the religious discourses were less formal than they became later (see HOMILY), and so were properly called 'homilies.' The earliest writer on the subject of homiletics is Saint Augustine, whose book *De Doctrina Christiana* is in some sense an adaptation of profane rhetoric to sacred uses. Rabanus Maurus and Isidore of Seville also incidentally treat the subject; but the nearest approach to a systematic treatment in mediæval literature is to be found in Hunibert, *De Eruditione Concionatorum*. Saint Carlo Borromeo's *Instructiones Pastorum* was a part of his general scheme for the improvement of clerical education; and in the ecclesiastical course, as well of Catholics as of Protestants, homiletics occupies an important place. Textbooks on homiletics have been written by Bautain, Broadus, Claude, Dabney, Hoppin, Kidder, Phelps, Shedd, Storrs, Vinet, and many others.

HOMILIA'RIUM (ML., from Lat. *homilia*, Gk. *ὁμιλία*, *homilia*, conversation, homily). A collection of homilies for the use of the clergy either to read to their congregations or for their own edification. Such collections were in use from the sixth century, for the use of those clergy who were unable or unwilling to write their own sermons. The homilies of the Venerable Bede were in familiar use among the clergy in all parts of the West, and we find in the letters of the early mediæval time traces of an interchange of sermons, original or otherwise, between bishops and clergy, even in distant countries. Alcuin made an homiliarium, which, strangely enough, considering its author, passed out of mind and was only discovered in 1892. What since the fifteenth century has been called his is really a revision of that by Warnefried mentioned below. One of the many reformatory measures of Charlemagne was a compilation of homilies under the title of 'Homiliarium,' which was made under his direction by the deacon, Paul Warnefried, a monk of Monte Cassino and one of his chaplains. It was compiled in the end of the eighth century, and contains homilies for all the Sundays and festivals of the year. It is the most famous of these collections. Maximus of Turin (fifth century, homilies in Migne, *Patrol. Lat.*, lvii.) is more drawn upon than any other author, but Bede comes next, and then Leo the Great, Gregory the Great, Augustine, and others. The language was, of course, Latin. Many synods directed the clergy to translate these sermons for their flocks, and the collection continued in use for this purpose down to the sixteenth century. It was printed at Speyer in 1482, and again at Cologne in 1557, and is reprinted in Migne, *Patrol. Lat.*, xcv. A collection of English homilies turned into verse, that they might be more readily remembered by the people, appears to have been composed about the middle of the thirteenth century. This collection, affording a metrical sermon for every Sunday and festival day in the year, exists in manuscript; and a portion of it was edited with introduction and notes by John Small, librarian to the University of Edinburgh (*English Metrical Homilies*, Edinburgh, 1862). When the Reformation was introduced into England the unfitness of the clergy to preach was so keenly felt that a book of homilies was prepared and sent forth by authority of Edward VI. (1547), and again under

Elizabeth (1563) a second book, and the reading of these homilies was enjoined. The two books were reprinted at Oxford, 1859. See Homily; Homilies of the Church of England.

HOMILIES OF THE CHURCH OF ENGLAND. A collection of sermons, the first part of which was published in 1547, the first year of the reign of Edward VI., to be read in the churches, partly in order to supply the defect of sermons, but partly also to secure uniformity of doctrine, and to guard against the heterodoxies, old and new, which threatened the unconsolidated Church. The second part was published in 1563, at the same time with the Articles, under Elizabeth. The titles are twenty-one in number. The homilies are not now read in churches; but they are frequently appealed to in controversies as to the doctrine of the Anglican Church on the points of which they treat. The precise degree of authority due to them is matter of doubt.

HOM'ILY. In ecclesiastical usage, a discourse held in the church, and addressed by the minister to the congregation. The practice of explaining in a popular form the lessons of Scripture read in the synagogues had prevailed among the Jews, and appears to have been adopted in the Christian churches from the earliest times. The discourses employed for this purpose were of the most simple character; but with the exception of one ascribed to Hippolytus (q.v.), we have no sample of this form of composition earlier than the homilies of Origen, in the third century. Taking these as a type, the early Christian homily may be described as a popular exposition of a portion of Scripture, accompanied by moral reflections and exhortations. It differs from the sermon (Gk. λόγος, Lat. *oratio*) in eschewing all oratorical display, and in following the order of the scriptural text or narrative, instead of being thrown into the form of a rhetorical discourse or a didactic essay. The schools of Alexandria and Antioch appear to have been the great centres of this class of sacred literature, and in the early centuries and mediæval times many preachers continued to use the homiletic form; and even in the modern Church many have regarded it as the best medium of scriptural instruction. See Homiliarium; Homiletics; Homilies of the Church of England.

HOMINE REPLEGIANDO, hŏm'ĭ-nē rē-plē'-jĭ-ăn'dō (ML., for replevying a man). The title of an old writ in English law, meaning to bail a man out of prison. It was an ancient form of the writ of habeas corpus, by the later form of which, as now employed, it has been superseded in England and generally in the United States. In a few of the American States, however, the older writ has recently been revived in an amended form, as being better adapted to the purpose of securing the release of a prisoner on bail than the more usual writ of habeas corpus (q.v.).

HOMING PIGEON, or Homer. The name among fanciers for that breed of domestic pigeon, also called 'carrier,' used in carrying messages and in long-distance races. The name refers to its proclivity for returning to its home with the utmost possible speed and directness when liberated at a distance. See Pigeon.

HOMIN'IDÆ (Neo-Lat. nom. pl., from Lat. *homo*, man). The family to which man belongs, and which, together with the various families of monkeys, baboons, and apes, forms part of the order Primates. Among the characters which distinguish the Hominidæ are: (1) The posture is completely erect; (2) the anterior appendages are provided with hands, the posterior with feet; (3) the feet have the inner digit greatly enlarged and non-opposable, forming a great toe; (4) the body is sparsely haired, except on the top of the head; (5) the lower jaw has a prominent ridge, the chin; (6) the facial angle exceeds 60°; (7) the brain is more than double the size of that of apes, and the cranial capacity three times as much; (8) the teeth stand in an uninterrupted series without a space in front of the upper incisors; (9) man has the power of speech. In his general organization man is so closely related to the higher apes that it is difficult to draw a hard and fast line between the Hominidæ and the lower groups. See *Anthropoid Apes*, under Apes.

HOMMEL, hôm'mel, Fritz (1854—). A German Orientalist, born at Ansbach. He was educated at Leipzig, and in 1877 became connected with the library of Munich, and was made docent of the university, in which he was appointed professor in 1885. His principal writings, aside from contributions to Oriental journals, are: *Die Namen der Säugethiere bei den südsemitischen Völkern* (1879); *Zwei Jagdinschriften Asurbanipals* (1879); *Die semitischen Völker und Sprachen* (1883); *Geschichte Babyloniens und Assyriens* (1885); *Der babylonische Ursprung der ägyptischen Kultur* (1892); *Aufsätze und Abhandlungen arabistisch-semitologischen Inhalts*, vols. i.-iii. (1892-1902); *Südarabische Chrestomathie* (1893); *Die altisraelitische Ueberlieferung in inschriftlicher Beleuchtung* (1896); *Sumerische Lesestücke* (last ed. 1899); *Der Gestirndienst der alten Araber* (1900).

HOMME QUI RIT, L', lōm' kē rē' (Fr., the man who laughs). A romance by Victor Hugo (1869), the story of a boy whose face has been mutilated so that he always has the appearance of laughing. The central thought of the romance is the antithesis between physical and moral characteristics.

HO'MOCŒ'LA. See Heterocœla.

HO'MŒOP'ATHY (from Gk. ὁμοιοπάθεια, *homoiopatheia*, similarity of feeling, from ὁμοιοπαθήσ, *homoiopathēs*, subject to like feeling, from ὅμοιος, *homoios*, similar + πάθος, *pathos*, feeling). A distinctive system of medicine elaborated by Samuel Hahnemann (q.v.) upon the suggestions of a number of predecessors, and published in 1796. His chief dicta enunciated at that time were as follows:

"Every powerful medicinal substance produces in the human body a peculiar kind of disease; the more powerful the medicine, the more peculiar, marked, and violent the disease." "We should imitate nature, which sometimes cures a chronic disease by superadding another, and employ, in the disease we wish to cure, that medicine which is able to produce another very similar artificial disease, and the former will be cured, *similia similibus*." He was brought to this conclusion through observing the toxic effects of drugs, as recorded in the various works on materia medica, which he was translating from English into German, and by experiments made upon himself and others in corroboration. It is not claimed that Hahnemann first noted similarity of drug action and diseased condition, for many times in previous medical history had isolated instances been noticed; but he was the first to urge a general application of his principles and to state the propositions upon which were based the new treatment. In 1806, in a treatise entitled *The Medicine of Experience*, he indicated the name by which the new system of treatment should be known, and thenceforward HOMŒOPATHY designated the science and art, as did 'homœopathic' the practitioner.

In 1810 he published the *Organon of Rational Medicine*, which became and remains the embodiment of the fundamental methods of homœopathy. These fundamentals may be stated briefly thus:

(1) Proving of medicines upon the healthy.
(2) Selection and administration of medicines according to the law of similars.
(3) The single remedy.
(4) The minimum dose.

A medicine is 'proved,' according to the homœopathic method, as follows: A fluid extract or a tincture of a drug is selected for 'proving.' Of this medicinal preparation a dose of one drop, two drops, or five drops is given to a healthy person at certain intervals, during which the person notes his symptoms. Gradually increasing doses are administered until the experimenter is satisfied and a set of tables of symptoms, believed to be caused by the drug in the healthy person, have been compiled. These tables of symptoms are then compared with symptoms noted in various diseases. Upon discovering that a disease presents a similar set of symptoms to those noted, by the healthy person, as caused by the test drug, the homœopathist argues that this drug will be the remedy for this disease. His method of reasoning is that if a drug produces certain symptoms in health it will cure a disease which causes similar symptoms. Upon this basis lies the fundamental 'law of similars,' generally stated in Latin, *similia similibus curantur*.

In the way just described, Hahnemann proved upon himself and others more than ninety drugs. Societies were formed for the purpose; and since his death many medicinal substances have been tested to learn toxic, pathogenic, and curative power, if any. Thus each drug had its pathogenesis or 'picture,' and the one corresponding to the totality of diseased symptoms as elicited from the patient by the physician, if administered, would, according to the homœopathic claim, result in a cure. No two drugs having precisely the same picture and no two patients the like totality of symptoms, he therefore individualized his cases, and declared that a single remedy should be given. Later in life he modified this to some extent, and, recognizing the *genus epidemicus*, prescribed without seeing the patients, as in the cholera epidemic of 1831.

When he began prescribing according to his law, he gave massive doses; but, believing that the human system when diseased is much more sensitive than in health, he gradually lessened the quantity. Then it was that he wrote the *Spirit of the Homœopathic Doctrine*, in which he argued the morbific cause of disease and the dynamization of remedies. In regard to disease, Hahnemann recognized the *morbific cause*, which, acting upon the *morbid properties* in the tissues, developed *disease*. Therefore, he argued, disease is a morbid property developed into an active pathological state by the influence of a corresponding morbific force. Likewise regarding drugs. His idea was that the drug forces are cosmic principles or agents of the same order as the disease-developing forces; the germinal principles inherent in the plant correspond with the morbid properties in the tissues, and drugs correspond with the fully developed disease. He believed that the morbific cause is in closer affinity with the drug than with the tissues of the organism, and this union secures the restoration of the organism to a state of physiological harmony. He said, "As the human organism, even in health, is more readily influenced by drugs than by natural morbific agents, this influence is felt in the highest degree by an organism which is properly predisposed by disease, provided the artificial drug disease is homœopathic to the natural malady. Hence the smallest dose of the remedial agent is sufficient for a cure, for the spiritual power of the medicine does not, in this instance, accomplish its object by means of quantity, but by potentiality and quality; a larger dose might be injurious, for this reason, that a larger dose does not only not overcome the morbid affection more certainly than the smallest possible dose of the homœopathically administered agent, but likewise imposes a complex medicinal disease, which is always a malady, though it runs its course in a shorter time." Herein lie the doctrines of small doses and 'medicinal aggravations.' From this mode of accounting for a cure in accordance with the law 'Similia similibus,' there naturally followed the 'potentization' of drugs, according to Hahnemann.

The attenuation was accomplished in the following manner: If the drug was a vegetable substance, a strong tincture was made and called mother-tincture. Of this, two drops were taken, added to 98 drops of alcohol, and agitated. This was marked first dilution. Two drops of this with 98 drops of alcohol constituted the second dilution, the third in a similar manner, and so on. This constituted what was known as the centesimal scale. Some preferred adding one drop of tincture to nine drops of alcohol, the label being first decimal, second, third, etc., according to the number of attenuation desired. Insoluble substances were triturated with sugar of milk in the proportions of one grain of the drug to 99 of sugar, or 9, as the physician deemed best. When the fifth trituration was reached, the substance, now claimed to be soluble, was dissolved in distilled water, and the further process carried on with alcohol as in the case of tinctures.

Hahnemann writes, quoting from the first American edition of *Organon de' Medicini* (Philadelphia, 1836): "Diseases are *dynamic* (spiritual) aberrations, which our *spiritual* existence undergoes in its mode of feeling and acting—that is to say, *immaterial* changes in the state of health" (p. 19). "A homœopathic dose, however, can scarcely ever be made so small as not to amend and, indeed, perfectly cure" (p. 157). "It will stand good as a homœopathic rule of cure, refutable by no experience whatever, that the *best dose* of the rightly selected medicine is ever the *smallest*" (p. 187). When describing the preparation of 'potences' of fluid dilutions, the author says: "These manipulations are to be conducted thus" (by adding 2 drops of a preceding 'potence' to 98 drops of alcohol and shaking twice) "from the first up to the thirtieth or decillionth development of power, which is the one in most general use" (p. 200). The effect of shaking, on homœopathic medicines, "is so energetic that latterly I have been forced by experience to reduce the number of shakes to two, of which I formerly prescribed ten to each dilution" (p. 205). "The best mode of administration is to make use of small globules of sugar, the size of a mustard-seed; one of these globules having imbibed the medicine, and being introduced into the vehicle, forms a dose containing about the three-hundredth part of a drop; for three hundred of such globules will imbibe one drop of alcohol." "By placing one of these on the tongue, and not drinking anything after it, the dose is considerably diminished. But if the patient is very sensitive, and it is necessary to employ the smallest dose possible, and attain at the same time the most speedy results, it will be sufficient to let him smell once" (p. 207).

The directions for smelling a 'remedy' are as follows: "The patient should hold the phial containing the globule under one nostril, when one momentary inhalation of the air in the phial is to be made; and if the dose is intended to be stronger, the same operation may be repeated with the other nostril" (p. 191). Hahnemann considered mesmerism a homœopathic remedy. He says: "This curative power, of whose efficacy none but madmen can entertain a doubt, which through the powerful will of a well-intentioned individual, influences the body of the patient by the touch, acts homœopathically, by exciting symptoms analogous to those of the malady" (p. 210).

In 1813 an epidemic of typhus fever occurred in Leipzig, during which it is said that seventy-three patients were allotted to Hahnemann for treatment. Of these it is claimed that but one died. Many of his claims were denied and many of his ideas were ridiculed. As a result of the opposition of the apothecaries' guild he was forbidden to prepare his own medicines for pay. In spite of all opposition, he and his pupils continued their practice and gave the remedies gratuitously when they were not allowed to take pay. Finally, opposition and social ostracism so discouraged Hahnemann that he left Leipzig in 1820 for Rothen, where, under the patronage of the Duke of Anhalt, he had a certain vogue. Up to this time homœopathy was centred in the person and teachings of Hahnemann; but now that he was absent, his pupils, already having become doctors of medicine, began, in 1821, the publication of the first homœopathic journal, the *Archive of the Homœopathic Method of Curing.* This publication was continued until 1843. The growth of homœopathy in Germany has ever been slow. In Austria, homœopathy was first officially known in 1819, in which year the Emperor Francis I. decreed that the method should be forbidden. Afterwards it was tacitly permitted, and the decree was revoked in 1837. Since 1846 there has been no governmental interference with individual preference. Homœopathy was introduced into Russia in 1823. There, as elsewhere, its pioneers were laymen, and its growth has been slow. It was introduced into Great Britain in 1827, by Quin, a physician. Shortly after, the medical opposition was so great as to prevent those who desired to practice it from obtaining a decree entitling them to register as physicians. At present there are no restrictions placed upon any person desiring to practice this system, but there are no legally incorporated schools for instruction. In France, homœopathy was first systematically tried in the year 1830. It steadily grew in favor until 1835, when Hahnemann, settling in Paris, gave the cause a powerful impetus. He grouped around him a large number of able men, and until his death in 1843 Paris was the Mecca of homœopathy.

The laws of France, as of most countries in Europe, discriminate against homœopathy, and no place of public preferment or emolument is allowed its adherents. As a rule, homœopathic medical colleges are not legalized in European countries.

In the United States, and in other young countries, homœopathy has been most active. Dr. Hans B. Gram, a native of Boston, educated at Copenhagen, first began the practice of homœopathy in New York City. The novel method was adopted by many, and many became earnest advocates of the system. Later, and about the same time, there came into notice men and women, generally and very largely of the laity, who, without knowledge of disease or of science, began to report cures with the aid of homœopathic 'remedies.' Domestic practice was so easy, by means of a cabinet of phials filled with globules and a book giving complete instruction for the use of homœopathic medicines as adapted to any symptoms, without the need of a diagnosis of disease, that the new cult grew rapidly. Soon there came from over the sea men who had learned the science and art from Hahnemann and his associates, and as a help to the more perfect understanding of this way, the first homœopathic college was established at Allentown, Pa., in the year 1835. While the converts to homœopathy have never been subjected to positive repressive legislation, yet they have been buffeted by the same storm of opposition as greeted their brethren in other lands. In order that the cause might be strengthened and physicians record progress, the publication of the *American Journal of Homœopathy* was begun in 1835. The American Institute of Homœopathy, the oldest national medical association in the country, was organized in 1844, though there were already societies in the States of Pennsylvania, New York, and Massachusetts. The existence of most of the local societies is mainly due to the suggestion and fostering care of the American Institute, to which they annually report.

In 1900 there were in the United States about 15,000 homœopathic physicians, and about eighteen medical colleges in which homœopathic therapeutics are taught. Considering its age, homœopathy is especially rich in theoretical and practical literature. The most exhaustive work on any division of the subject is the *Encyclopædia of Materia Medica*, by the late Prof. T. F. Allen, M.D., of New York City. Every department of medicine has been treated by homœopathic authors. Perhaps the chief factor in the spread of homœopathy in this country, especially in the newer portions of the Western States, is the equality of all schools of medicine and all qualified practitioners before the law. For many years homœopathists in this country taught only therapeutics and practice, and as a result all the earlier, and for many years most of the well-equipped, native American physicians were graduates of the regular school. Finally, homœopathic medical schools were established, in which all the branches of medicine were taught, and the inexplicable terms 'homœopathic surgeon' and 'homœopathic obstetrician' came into use. The influence of the school has been waning for some years. In 1883 the *Hahnemannian Monthly* said: "A few years ago the editors of the *New York Medical Times* dropped from the title of their journal the distinctive word 'Homœopathic'; now they boldly urge the renunciation of the word as applied to our school of medicine. If we are emancipated from the thraldom of sect, we shall not only save our school from imminent dissolution, but shall also become an integral part of the medical profession of the day, honored as true, broad, liberal, progressive physicians. But if we cling to a name which by no means represents the catholicity and spirit of the new school, we are doomed to annihilation."

In the large cities of the Eastern States, great numbers of graduates of homœopathic medical schools have taken courses of study in post-graduate departments of regular medical colleges, and afterwards, while retaining the term homœopathic, practice medicine principally according to the regular principles, using 'old-school' drugs in 'old-school' dosage. The editor of the *New York Medical Times* (homœopathic) asserted that there are only two 'pure' homœopathic practitioners in that city.

Whether due to its influence or not, since the advent of homœopathy the repulsiveness in taste and appearance as well as the size of the dose of old-school remedies have been greatly modified; and in a vast number of cases suggestion and encouragement together, perhaps, with placebos, have taken the place of active medicinal treatment, and natural recuperative power has worked the cure. It is certainly true that without the resort to and adoption of regular 'old-school' remedies homœopathy would have died out except among those who love mystery and prefer magic to medicine. Few and rare today are the practitioners who adhere to the potentization tenets of Hahnemann, or who are content to treat symptoms in ignorance of the disease present.

The terms 'allopathy' and 'allopathic' came into use after the invention of the words 'homœopathy' and 'homœopathic,' and were used by the adherents of the new school in designating the old school and its practitioners, through a mistaken idea. The terms are etymologically incorrect. See Hahnemann.

HOMŒOPATHY, American Institute of. The oldest national medical organization in the United States, its first session having been held in New York City, on April 10, 1844. Its objects are the reformation and augmentation of the Materia Medica, and the furthering of the principles of homœopathy. It has two thousand members, divided into bureaus on various lines of medicine and surgery, and meets annually in the large cities of the country. The institute publishes annual volumes of "Transactions," including reports and original papers.

HO′MOGENE′ITY, Law of. The product of two homogeneous integral functions of the *m*th and the *n*th degree, respectively, is a homogeneous, integral function of the $(m+n)$th degree. The value of this principle in checking the process of multiplication of homogeneous functions is evident. The notion of homogeneity may be extended to irrational and fractional functions. In this case the degree is determined by introducing a factor *k* into each variable, and observing the degree of the factor *k* in the resulting function.

HOMOIOUSION, hō′moi-o͞o′sī-on. See Homoousion.

HOMOL′OGA′TION (from ML. *homologare*, to homologate, from Gk. *ὁμολογεῖν*, *homologein*, to agree, from *ὁμόλογος*, *homologos*, agreeing, from *ὁμός*, *homos*, same + *λόγος*, *logos*, word, from *λέγειν*, *legein*, to say). In the civil law, the judicial confirmation of an award, or of an accounting, or of any other administrative or judicial proceeding. In Scotch law, an act or course of conduct which confirms or approves of something which otherwise might be invalid. Thus, an informal deed, though useless in itself, yet if acted on by one or both parties, will be set up and made valid as against the party homologating. To constitute homologation, a clear knowledge of what the party is doing is necessary. Cf. Estoppel.

HOMOL′OGOUS SERIES. See Hydrocarbons.

HOMOL′OGY (from Gk. *ὁμολογία*, *homologia*, conformity, from *ὁμόλογος*, *homologos*, harmonizing, from *ὁμός*, *homos*, same + *-λογία*, *-logia*, account, from *λέγειν*, *legein*, to say). (1) In biology, a term used to indicate structural correspondence based on blood-relationship, as opposed to analogy, which is applied to functional resemblance, such as that between the wings of a bird and those of a butterfly. Different sorts of homology have been recognized. There is the homology of the different parts of the body; namely, serial homology, as of the front and hind paired fins of fishes, or the arms and legs of man; antimeric homology, as of the petals of a flower or the right and left sides of the body. There is homology of corresponding organs in different individuals. This is most certain in individuals of the same species; somewhat less certain between genera and families; often doubtful between orders and classes; usually speculative between phyla. The criteria of homology are: (a) The criterion of connections. A part having similar relations in two species, and making similar connections is homologous in the two cases. (b) The criterion of structure. Homologous parts have a fundamental similarity of structure. (c) The criterion of development. Homologous organs arise from the same germ-layer in corresponding parts of the body and develop in the same fashion. Despite these clear-cut criteria, homologies are practically often very difficult of determination, particularly beyond the limits of a class.

(2) In geometry, figures which are in perspective are often spoken of as homologous, because the centre and axis of perspective introduced by Poncelet were called by Chasles centre and axis of homology. (See the articles Centre; Axis.) The term is used in another sense to signify the relation of reciprocity or duality (q.v.) which exists between geometry and algebra.

Law of Homology. Given two sets of concepts, G (geometric) and A (algebraic), such that to every concept in set G (for example, a rectangle, or a line) shall correspond a concept in set A (say, a product, or a number); and to every relation between any two of one set (for example, equality) a relation (in this case equality) between the corresponding two of the other, then all language, reasoning, and conclusions as to the one set may be applied to the other set.

This correspondence of one symbol, one operation, one result, etc., of algebra, to one symbol, one operation, one result, etc., of geometry, or, as it is called, this 'one-to-one correspondence,' suggests many theorems of geometry that would otherwise remain unnoticed. E.g.:

GEOMETRIC THEOREMS.	ALGEBRAIC THEOREMS.
If $x, y, z, \ldots$ are line segments, and $xy, xz, \ldots$ represent the rectangles of x and y, x and $z, \ldots$, and $x(y+z)$ represents the rectangle of x and $y+z$, and x^2 represents the square on x, then	If $a, b, c, \ldots$ are numbers, and $ab, ac \ldots$ represent the products of a and b, a and $c, \ldots$, and $a(b+c)$ represents the product of a and $b+c$, and a^2 represents the second power of a, then
1. $x(y+z)=xy+xz$.	1. $a(b+c)=ab+ac$.
2. $(x+y)^2=x^2+y^2+2xy$.	2. $(a+b)^2=a^2+b^2+2ab$.
3. $x^2-y^2=(x+y)(x-y)$.	3. $a^2-b^2=(a+b)(a-b)$.

HOM'ONYMS (Lat. *homonymus*, from Gk. *ὁμώνυμος*, having the same name, from *ὁμός*, *homos*, same + *ὄνομα*, *onoma*, name). Words that agree in form, but differ in origin and meaning. A familiar example of this class of words is *sound*, which in its different meanings goes back to the Latin *sonus*, Scandinavian *sund*, and Anglo-Saxon *gesund* and *sundian*. Many homonyms are often distinguished by the accent, as *absent*, the adjective, and *absent*, the verb. Strictly speaking, these are not homonyms, but homographs, since the exact correspondence is confined to the spelling. A third term is also used—'homophones,' words that agree in the sound, but not necessarily in the spelling. Thus *write*, *wright*, and *rite* are homophones.

HOMOOUSION, hō'mō-ōō'sĭ-on (Gk. *ὁμοούσιον*, *homoousion*, consubstantial, from *ὁμός*, *homos*, same + *οὐσία*, *ousia*, essence). A term of Greek theology, employed against the Arians at the Council of Nicæa (A.D. 325), to denote that in the doctrine of the Trinity the Son is "of the same essence [or substance] with the Father." According to the received text of what we call the Nicene Creed, the article in question reads: "And [I believe] in one Lord Jesus Christ . . . being of one substance with the Father." The word *homoousion* is much older than the Council of Nicæa. Not to speak of its employment by Gnostics, like Basilides, it is found in the writings of Irenæus, in the latter half of the second century, and not infrequently in the third century. It was rejected by a synod held in Antioch, against Paul of Samosata (268 or 269), where it seems to have borne a meaning somewhat different from that which was applied to it by Athanasius. In the fourth century the word aroused a long and bitter controversy. The Athanasian party defended it; the Arians attacked it on every side. In the progress of the struggle various alternatives were proposed. Some extreme Arians wished to substitute *heteroousion* (of a different substance) for *homoousion*, thus affirming the direct opposite of what the orthodox party insisted upon. Others, less radical and largely indifferent to the real issue involved, suggested the colorless term *homoion* (similar), meaning simply the Son 'is like' the Father. Others still were willing to go so far as to use the word *homoiousion* (i.e. the Son is 'of a like essence, or substance,' with the Father). After nearly sixty years of theological warfare, the Church, at the Council of Constantinople (381), reaffirmed its allegiance to the *homoousion* doctrine, and now applied it not simply to the Son, but also to the Holy Ghost, thus completing the dogma of the Trinity, which has ever since remained the orthodox faith of Christendom.

Consult: Harnack, *History of Dogma*, vol. iv., translation (London, 1898); Athanasius, *Select Works*, translation in the *Nicene and Post-Nicene Fathers*, second series, edited by Schaff and Wace, vol. iv. (New York, 1892); Dubose, *The Ecumenical Councils* (2d ed., New York, 1897). See ARIUS and NICENE CREED.

HO'MOPH'ONY (Gk. *ὁμόφωνος*, *homophōnos*, having the same sound, from *ὁμός*, *homos*, same + *φωνή*, *phōnē*, sound). The style of modern music where one voice or melody predominates. The other voices are not independent, but serve chiefly to furnish the harmonic basis for the leading voice. Thus it is directly opposed to the older polyphony (q.v.), where all voices were independent and of equal importance. See ANTIPHONY; MONODY.

HOMOP'LASY. A term proposed by Lankester to express, as he says, 'the parallelism of genetically distinct organs.' Its meaning by some is expressed by the word 'convergence,' now in frequent use. It is due to the action of similar or identical habits or environment on a part or parts of an animal or on the entire animal. Lankester's definition is: "When identical or nearly similar forces, or environments, act on two or more parts of an organism which are exactly or nearly alike, the resulting *modifications* of the various parts will be exactly or nearly alike." Lankester illustrates homoplasy by the case of the remarkable coincidence in the pteropod mollusks and cephalopod mollusks of appendages around or near the mouth provided with suckers. Osborn asserts that homoplasy has been confused with 'parallelism' and 'convergence,' which may affect absolutely non-homologous structures. *Homoplasy*, he says, should be confined to structures in which there is an element of homology. *Convergence* may be restricted to cases of 'parallelism' between animals of entirely unrelated groups or classes, like the following: Marsupial mice, and other animals of that group exactly resemble placental mice, etc.; whales resemble fishes owing to their similar adaptation to the water. Many cases of so-called mimicry (q.v.) appear to be instances of convergence. Legless lizards may be mistaken for snakes. There are multitudes of such examples, and the resemblance or parallelism is so exact as to have often misled well-trained zoölogists.

HOMOP'TERA (from Gk. *ὁμός*, *homos*, same + *πτερόν*, *pteron*, wing). A suborder of the Hemiptera including insects with wings (when present) of uniform thickness throughout. It contains some of the most destructive of insects and others that are the most beneficial. It includes the cicadas, lantern-flies, spittle-insects, leafhoppers and treehoppers, plant-lice, scale-insects, and others. A few of the scale-insects furnish materials that are useful to man, such as cochineal lac and wax. A famous scale-insect is the 'San José' scale, and the mealy bugs of greenhouses are well-known representatives of this group. See HEMIPTERA; BUG; COCHINEAL; APHID; CICADA; FROTH-FLY; SCALE-INSECT.

HOMOS'PORY (from Gk. ὁμός, *homos*, same + σπόρος, *sporos*, seed—literally, 'spores similar'). A word generally used only in connection with such plants as have a distinct alternation of generations (q.v.). The sexless generation (sporophyte) in the alternating series produces spores, which in turn produce the sexual generation (gametophyte). Among the liverworts and mosses (bryophytes), most of the ferns and their allies (pteridophytes), these spores are all alike in appearance and power, each in germination producing a gametophyte which bears both male and female organs. The term contrasts with 'heterospory' (q.v.), a condition in which the sporophyte produces two kinds of spores, unlike in size and power, the larger of which produce female gametophytes, the smaller male gametophytes. All the seed-plants (spermatophytes) are heterosporous, as well as the water-ferns, quillworts, and little club-mosses among the pteridophytes. Isospory is the same as homospory.

HOM'OTAXY, or **HOM'OTAX'IS** (from Gk. ὁμός, *homos*, same + τάξις, *taxis*, arrangement, from τάσσειν, *tassein*, to arrange). A geological term which signifies a similarity in the succession of strata in different regions as shown by the included life forms.

HOMS, hōms, or **HEMS**, hĕms (Lat. *Emesa*). A city of Syria, situated near the right bank of the Orontes, about 32 miles south of Hamah (Map: Turkey in Asia, G 5). It is built chiefly of black basalt; has crowded houses and narrow streets, and is surrounded by old half-ruined walls. Although there are now no ancient buildings remaining, the antiquity of the city is attested by numerous fragments of columns, by Greek inscriptions, and the foundations of ancient baths with specimens of mosaic pavements. The town has considerable trade in silk, cotton, oil, and gold ware, and has also some manufactures. The population is estimated at 60,000, including about 6500 Christians. Ancient Emesa was celebrated chiefly for its splendid temple of the sun, one of the priests of which, Elagabalus, or Heliogabalus, was raised to the Imperial throne of Rome. Under the walls of Emesa, Zenobia was defeated by the Emperor Aurelian in A.D. 272. The city was taken by the Saracens in 636, when its old Semitic name, Hems, was revived. In 1099 the Crusaders rode through its opened gates. Here the Egyptian army, under Ibrahim Pasha, defeated the Turks in July, 1832.

HOMURAI. See HORNBILL.

HO-NAN, hō'nän' (Chin., south of the river). One of the eighteen provinces of China proper, bounded on the north by the provinces of Shan-si and Chih-li, on the east by Shan-tung, Kiang-su, and Ngan-hwei, on the south by Hu-peh, and on the west by Shen-si (Map: China, D 5). It lies between the parallels of latitude 32° and 37° N., and the meridians of longitude 110° and 116° E.; area, about 67,000 square miles. The eastern part is comparatively level, and belongs to the Great Plain, while in the western section spurs of the Fu-niu range of mountains with a southeast trend are found. Its principal river is the Hoang-ho, which traverses the northern part from west to east. The soil is fertile, and in addition to the usual cereals, produces cotton, hemp, indigo, and tobacco. Patches of the remarkable formation called loess (q.v.) by Richthofen, and 'lake loam' or terrace deposit by Pumpelly, are found in both the northern and southern parts. Ho-nan is rich in minerals, iron, lead, tin, copper, etc., and has enormous deposits of anthracite coal, which has hitherto been mined only by native methods. The capital, Kai-fung (or fĕng), is situated 11 miles south of the Hoang-ho and near the point where in 1853 the river burst its banks and took a new course to the northeast through Shan-tung to the Gulf of Pe-chi-li, instead of southeast through Kiang-su to the Yellow Sea as formerly. Kai-fung is a station on the new *Lu-Han* or Hankow-Peking Railway. The people of the province are notorious for lawlessness and turbulence. Population, upward of 35,000,000.

HONDA, ōn'dȧ. A city of Colombia, situated on the Magdalena, in a mountainous region, 55 miles northwest of Bogotá (Map: Colombia, C 2). The town has a very hot climate, as the surrounding mountains shut off the cool winds. It is important as the head of navigation, and the transit point of the trade for Bogotá, as well as the depot for the tobacco and quinine from the Ambalema District. Population, 4000. Honda received its town charter in 1643. In 1805 it was destroyed by an earthquake.

HONDECOETER, hŏn'de-ko͞o'tẽr, MELCHIOR D' (1636-95). A Dutch animal painter. His grandfather, GILLIS (died 1627), was a landscape painter at Amsterdam, and his father, GISBERT D'HONDECOETER (died 1653), painted animals. Melchior was born at Utrecht, and studied under his father and his uncle, Jan Weenix (q.v.). From 1659 to 1663 he lived at The Hague, and after that at Amsterdam, where he received the freedom of the city in 1688, and resided until his death, April 3, 1695. He stood in high favor with the Dutch magnates, and while at The Hague was employed by William III., afterwards King of England, to paint his menagerie. His grandfather had made a considerable name in that form of art. Hondecoeter painted every kind of animal, but his favorite subjects were cocks, hens, ducks, and peacocks, which he delineated with wonderful correctness and truth. He depicts, with great charm, motifs like the maternity of the hen, and he even lends beauty to subjects like 'cock-fights,' and "Ducks in a Pond." No one has excelled, or even equaled him, in painting the feathered tribe. The landscapes which he introduced as backgrounds to his pictures are equally true to nature, and finished with a delicate lightness and transparency of touch that harmonizes admirably with the subject of the piece. The museums of France, Germany, and Austria, and the private and public collections of England have fine examples of his work, but his masterpieces are at Amsterdam and The Hague. His most celebrated work is "La plume flottante" (the Floating Feather), in the Museum of Amsterdam, representing a pond full of water-fowl.

HONDO, hŏn'dō, or **HON-SHIU**, hŏn'shyo͞o' (Chino-Japanese, chief island). The name of the chief island of the Empire of Japan, often, but incorrectly, called Nippon or Niphon (Map: Japan, E 6). Nippon is not the name of any one island, but of the entire Japanese Empire. The application of the erroneous name Nippon to the chief island originated with Kaempfer (q.v.), the Jesuits who wrote previously to him knowing Japanese geography too well to use the misleading term. Of late years the Japanese, studying geography in the Western fashion, and seeing the necessity of a name for their chief island, have called it Hondo. Hondo lies between latitude 24° 14′ and 41° 33′ N., and longitude 130° 44′ and 142° 14′ E., and has an area (with its isles) officially computed in 1894 at 87,771 square miles, with a population (December 31, 1898) of 33,327,918. It comprises the circuits of Tokaido, Go-Kinai (or the five home provinces), Tozando, Hokurikudo, Sanindo, Sanyodo, and one province of Nankaido (the other four provinces of this circuit forming the island of Shikoku). For administrative purposes Hondo is divided into 3 fu and 34 ken (or prefectures), and contains 447 districts, 34 large cities, 10,618 villages. Of its taxable area in acres, 7,250,000 are in rice-fields, 3,898,550 in arable land, 752,787 in building lots, and 15,490,807 in forest, besides 774,743 acres of untaxed land. Its shape is a crescent, with horns toward Asia. A remarkable difference in climate is noted between the eastern and the western halves of Hondo, the former, under the influence of the Kuro-Shiwo, or gulf stream of the Pacific, being mild and warm; the latter, receiving the cold winds and under the influence of cold currents, having a more severe climate. The promontories of Hondo are now dotted with well-equipped lighthouses, and the island is well supplied with railways and telegraphs.

HONDT, hŏnt, **HOND,** or **HONDIUS.** A Flemish family of painters and engravers. Jodocus or Josse (1546-1611) was born at Wacken. To avoid the troubles in the Netherlands, then in the throes of the war with Spain, he went to England and became an engraver of maps and a maker of mathematical instruments. He also engraved some portraits, such as those of Queen Elizabeth, Henry IV., Drake, and Cavendish; some plates for Mercator's *Atlas Major* (1605), and other works. He often added to his signature the figure of a dog, in allusion to his name.—His son, Hendrik (1588-1658), called the Younger, was born in London. He was also an engraver, and is said to have executed many plates, but his works are confused with those of another Hendrick Hondt (1573-1648), born at Duffel in Brabant, the son of William Hondt, and a pupil of Jan Wierix. The first named opened a studio at The Hague, and during fifty years produced many plates, including a series of portraits of the great reformers, Wyclif, Melanchthon, Knox, Calvin, and Savonarola, and a series of painters, besides genre and historical subjects.—Another William Hondt (1601-c.1632) was the son of Hendrick (1573-1648). He was born at The Hague, and is said to have been Court painter to Ladislas IV., King of Poland. His works include a portrait of the King, and a number of engraved portraits after Van Dyck and others, notably one of himself after that master.—Abraham (1638-95), a painter and engraver, was born at Rotterdam. He was the grandson of Jodocus or Josse Hondt, and was known especially as a painter of dogs. He went to London while very young, and under Charles II. acquired a great reputation for his studies of the chase. He also painted torch-light scenes, and left some rare water-colors. There is a "Wild Boar Hunt" by him in the Metropolitan Museum of Art, New York City.

HONDURAS, hŏn-dōō′ràs, *Sp. pron.* ōn-dōō′ràs. A republic of Central America, bounded by the Caribbean Sea on the north and northeast, Nicaragua on the southeast, Salvador and the Pacific Ocean on the southwest, and Guatemala on the west (Map: Central America, D 3). **Area,** estimated at over 46,000 square miles. It is a mountainous country, a plateau in the interior, with low coast lands. The only plains of important extent are along the coasts of both oceans, and on the lower courses of a few rivers. The widening of river valleys in the interior results in small plains, many of them at a considerable elevation. The mountains occupy a proportionately larger area than in neighboring Guatemala, but the ranges are inferior in extent and height, though some peaks rise to about 8000 feet. Volcanoes have recently played a smaller rôle than in any other country of Central America, though there are an important number of extinct volcanoes, one of which formed the island of Sacategrande in the Gulf of Fonseca. In the western half of Honduras, young eruptive rocks cover as large an area as all the other geological formations together, while in the eastern half very little of the surface is formed of volcanic outpourings of recent geological times, though the older eruptive rocks are largely represented, particularly in the north. The coasts have a long Atlantic and a small Pacific frontage. The Atlantic ports are Trujillo, Ceiba, and Puerto Cortés. Amapala has one of the best natural harbors on the Pacific coast. The water parting between the Atlantic and Pacific rivers is far to the south, so that most of the drainage is to the Atlantic Ocean. Some of the Atlantic rivers are navigable, among them being the Coco or Segovia (known also as the Wanks), which forms part of the boundary with Nicaragua.

In the interior the climate is healthful, and on the whole temperate. The coast lands, owing to their small elevation, have a much higher temperature. Honduras, swept by the trade winds receives an enormous quantity of rain, and the tropical vegetation is very luxuriant. The broad Atlantic coastal lowlands, however, receive much less rainfall than the mountain regions of the interior, where most of the water vapor brought by the east winds is condensed. The result is that though the eastern lowlands are covered with vast forests of mahogany, cedars, and other cabinet woods, in which also sarsaparilla and other medicinal plants abound, vegetation in the east is not so luxuriant as in the higher regions inland, where there are boundless forests of pines and other conifers so dense that one may travel for days without being able to see more than 100 yards in any direction. The Pacific coast is driest, and a dry period prevails from November to May. The Atlantic coast is not healthful for the white race, and its products are mainly those of the forest and tropical fruits. The interior, from 1500 to 7000 feet, produces tropical products in the lower zone, coffee in the middle zone, and the products of temperate climates in the upper belt. Numerous relics of a former civilization are found in some districts, most of them being the ruins of temples and other religious edifices.

For fauna, see NEOTROPICAL REGION.

MINERAL RESOURCES. The country is richer in minerals than any other Central American State excepting Nicaragua. They include gold, silver, copper, zinc, iron, lignite, etc. Lack of capital and energy, however, has prevented the large development of these resources. The mining activities are practically confined to the washing of gold from the rivers and the production of some silver in the southern part of the country, these metals being the largest exports.

AGRICULTURE. The soil is very rich; but in spite of its unusual fitness for agriculture, Honduras is the most backward State of Central America. The natural conditions are conducive to the cultivation of almost all the products of Central America, but the sparsity of population as well as the lack of transportation facilities stand in the way of agricultural development. More attention is paid to stock-raising and to the cultivation of bananas and other fruits in the Atlantic coastal region than to any other branch of farming. Steamers carry a large quantity of bananas and cocoanuts to the United States. Tobacco, sugar, maize (the chief food staple), coffee, rice, etc., are all grown in quantities sufficient to supply the local demand, and considerable coffee is sold abroad. The almost prohibitive export duties have brought about a considerable increase in the live stock of the country. The exports of live cattle, however, as well as of hides, are not unimportant. Sheep, goats, and swine are few in number.

TRANSPORTATION. With regard to transportation facilities the situation in Honduras is worse than in any other of the Central American States, although the natural obstacles in the way of a railway line from coast to coast are less than in most of the other States. The construction of a narrow-gauge line from Puerto Cortés on the Atlantic to the Gulf of Fonseca on the Pacific was begun in 1868 by an English company, which had secured from the Government a land grant of ten square miles per mile of road constructed, and extensive mining and lumbering privileges. Bonds to the amount of $30,000,000 were issued and sold, but the work was discontinued after about 60 miles, or one-fourth of the road, was constructed. Since then all efforts to resume construction have been unsuccessful, and the part completed, between Puerto Cortés and La Pimenta, has been operated with varying success by several companies. A mule train is three weeks on the road between Puerto Cortés on the Atlantic and the Pacific port of Amapala, a journey that might be made in less than a day if this railroad were completed. Several concessions for shorter roads have been obtained by foreign companies from the Government. There are a number of tolerable wagon-roads, but most of the traffic is still carried by mules. The telegraph lines of the country had 2730 miles of wire in 1899.

COMMERCE. The commerce of Honduras is naturally insignificant in view of the general backwardness of the country. The imports in 1900 were estimated to amount to 1,074,050 pesos gold, of which over two-thirds came from the United States. The exports were valued at over 2,635,600 pesos gold, and consisted of precious metals, fruit, cattle, coffee, cabinet woods, tobacco, hides, and skins. The skins of the roebuck and the feathers of tropical birds are also important in trade. One-half of the exports of Honduras find their way to the United States, the remainder being principally divided between Germany and the other Central American States. The chief articles imported from the United States to Honduras are breadstuffs, cotton manufactures, iron and steel manufactures, and beverages, almost the entire import trade being usually with this country.

GOVERNMENT. The Constitution of Honduras, as modified in 1894, provides for a republican form of government. The executive power is vested in the President, elected by popular vote for a term of four years. The Chamber of Deputies, which is intrusted with the exercise of the legislative power, is composed of Deputies elected directly for four years, at the rate of one Deputy for every 10,000 inhabitants. The President is assisted in his duties by a Cabinet of Ministers. For administrative purposes the republic is divided into 15 departments, administered by governors appointed by the President. The administration of justice is in the hands of a supreme court, situated at the capital, and a number of minor tribunals and justices of the peace. The capital is Tegucigalpa.

FINANCE. The chief sources of revenue are customs duties and the spirits, powder, and tobacco monopolies. The revenue for 1900-01 was estimated at 2,423,000 pesos, and the expenditure at 2,416,824 pesos, of which about one-third was spent by the Department of War. The finances of the country are in a deplorable condition, owing to the expenditures incurred during the war with Salvador and Guatemala, and to the continuous civil strife as well as to general mismanagement. Thus the external debt of the country amounted in 1900 to $26,992,850, while the arrears of interest at the same period amounted to $64,498,440, bringing up the foreign indebtedness of the country to $91,491,290. The internal debt amounted in 1900 to 1,800,812 pesos.

DEFENSE. Military service is obligatory upon every able-bodied citizen between the ages of eighteen and forty. The active army is very small, being estimated at only about 500 men. The militia numbers over 40,000.

POPULATION. The population of Honduras was 587,500 in 1900, exclusive of (uncivilized) Indians. Most of the population are called aboriginal 'Indians.' The number of persons of pure European descent is very small. Religious freedom is provided for by the Constitution, and no religion is officially recognized by the State. The prevailing religion is Roman Catholic, but there are also a number of Protestant churches. Education is supported by the State to a considerable degree, but the present facilities are far from adequate. In 1901 there were nearly 800 primary schools, of which 700 were national, all attended by about 29,000 pupils. There are also a high school for girls, and a normal school, both situated at Tegucigalpa, besides six national colleges and seven other educational institutions that receive subventions from the Government. There is also a national industrial school. Most of the departments of the republic are provided with national colleges, and there are also some institutions for higher education. As regards penal and charitable institutions, there are a penitentiary and general hospital at Tegucigalpa; also a hospital at Amapala.

History. The coast of Honduras was discovered by Columbus in 1502. The first settlement was made in 1524, by Cristóbal de Olid, a lieutenant of Cortés, sent to take possession of the country in the name of his commander. Olid founded the town of Triunfo de la Cruz, and set up an independent government. Cortés set out in person to bring Olid to terms, and after a tedious march of six months over the mountains and rivers of Mexico and Central America, he reached the little colony in the spring of 1525. There he reënforced the colonists and founded the town of Natividad de Nuestra Señora, on Caballos Bay, returning to Mexico in 1526. A royal Governor was appointed to rule the province. The mines of Honduras were valuable, but under Spanish government the colony developed slowly. In 1539 the province was made an audiencia of the Captain-Generalcy of Guatemala. The laws enacted for the protection of the natives were systematically disregarded. In 1821 Honduras revolted from Spain, and was annexed to the Mexican Empire. In 1823 it joined the federation of Central American States which was formed in October of that year, and lasted until 1838, when it was virtually dissolved, although the President's term did not expire until February 1, 1839. In 1849-51 Honduras formed a union with Salvador and Nicaragua, which ended in 1863 in war between the contracting parties. Between 1856 and 1860 the usual course of internal dissension was interrupted by the filibustering exploits of William Walker (q.v.). In 1871 war broke out between Honduras and Salvador and Guatemala, and after peace was declared, in 1874, a revolution in the interests of the ex-President, Medina, took place. Other States interfered, and the Guatemalan candidate, Soto, acted at first as provisional President, and was elected to that office in April, 1877. In 1880 the national capital was removed from Comayagua to Tegucigalpa and Soto was reëlected President. In 1899 General Sierra was chosen President for the term ending in 1903.

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HONDURAS, Bay of. An inlet of the Caribbean Sea, between British Honduras, Guatemala, and Honduras (Map: Central America, D 2). It forms several inlets and contains the island of Turneffe, and the Bay Islands, of the coast of Honduras.

HONDURAS, British. See British Honduras.

HONE, Philip (1780-1851). An American merchant and politician. He was born in New York City, where with his brother he built up a good business as an auctioneer. In 1816 he established the first savings bank in New York; was Mayor of the city in 1826; and founded the Mercantile Library Association. He had been a Federalist, joined in the formation of the Whig Party and, it is said, gave it that name. He was prominent in national politics, where he opposed Jackson, and later condemned abolition, and was a man of taste and some learning. He wrote a diary for the years 1828 to 1851, which, edited in part by Tuckerman (1889), gives valuable impressions of life in New York and of the early days of the Whig Party.

HONE, William (1780-1842). An English author, born at Bath. He was brought up in the strictest piety, even learning to read and write from the Bible. When ten years old he was apprenticed to a London attorney. He afterwards set up as bookseller, but did not succeed. He gained a contemporary notoriety by his satires on the Government, which were illustrated by Cruikshank. For his parodies on the prayer-book he was prosecuted, but acquitted. His *Political House that Jack Built* (1819) ran through 54 editions. Withdrawing from politics, he produced works of more permanent value, as: *Ancient Mysteries* (1823); a new edition of Strutt's *Sports and Pastimes* (1830); *Every Day Book* (1826-27); *Table Talk* (1827-28); *The Year Book* (1832); and many cheap and popular reprints. During his last years he frequently preached. He died at Tottenham. Some of the most characteristic of Hone's works have been reprinted by W. Tegg: *Every Day Book*, *Table Talk*, and *Year Book* (1873); and *The Three Trials*, an account of his prosecution by the Government (1876).

HONES (AS. *hān*, Icel. *hein*, stone; ultimately connected with Lat. *cuneus*, Gk. *κῶνος*, *kōnos*, wedge, Skt. *śāna*, whetstone, from *śā*, *śi*, to sharpen), or Whetstones. A particular class of stones used for the purpose of sharpening edge-tools, such as razors, knives, scythes, etc. They are usually cut into pieces of convenient size, according to their intended uses. The finest kind of hones are those called oil-stones; these are hard, compact, and so very siliceous that they readily wear down the hardest steel; they are varieties of slate, derived from the argillaceous schists of the Paleozoic period. These stones are found in Turkey, Bohemia, Persia, in the Harz Mountains, in Styria, in the United States, Spain, Peru, and in Siberia. In Great Britain several localities yield hone-stones of excellent quality, and none better than the celebrated Water-of-Ayr stone, which is much used for polishing copper plates, as well as for hones. The hones used for sharpening scythes, etc., are usually made of coarse-grained sandstone. One of the best American stones for hones comes from Arkansas. In addition, there are artificial stones formed from abrasive materials, which possess advantages for certain purposes. See Abrasives.

HONESDALE. A borough and the county-seat of Wayne County, Pa., 32 miles northeast of Scranton; on the Lackawaxen River, and on the Delaware and Hudson Company's and the Erie railroads (Map: Pennsylvania, F 2). It has a public library and several public parks. As the centre of a highly productive coal-mining district, Honesdale carries on an extensive coal trade, and manufactures cut glass, boots and shoes, silk and woolen goods, axes, foundry products, elevators, flour, etc. Population, in 1890, 2816; in 1900, 2864.

HONEST GEORGE. A nickname given to George Monck, first Lord Albemarle.

HONEST MAN'S FORTUNE, The. A play by Fletcher and Massinger and possibly others, performed in 1613 and printed in 1747. Accompanying it is a set of verses, *Upon an Honest Man's Fortune*, signed by Fletcher.

HONEST MAN'S REVENGE, The. See Atheist's Tragedy, The.

HONEST WHORE, The. A play in two parts by Dekker, and perhaps Middleton, the first part of which was published in 1604. The earliest extant edition of the second part was not printed until 1630. Its full title as originally published is *The Honest Whore, with the Humours of the Patient Man, and the Longing Wife.*

HONEY (AS. *hunig*, OHG. *honag*, *honang*, Ger. *Honig*, of uncertain origin). A thick, sweet liquid, of more or less pronounced flavor, produced by bees of various kinds and by other insects. The neuter or working bees gather the nectar from the nectaries of flowers (and other sweet substances if flowers are lacking), extracting it by means of the proboscis and passing it into the crop or honey-bag. The bee disgorges the honey into the cells of the comb. Apparently the sweet substance undergoes some change in the honey-bag, as honey differs in flavor from the nectar of the flowers from which it is gathered. The consistency of honey varies with age, and is influenced by its source, that from some flowers being much thicker than that from others. The flavor also varies with the source from which it is gathered, that from clover, sweet clover, basswood or linden flowers, for instance, being very agreeable; that from buckwheat is darker colored and less liked by some. Age also affects the flavor. Some honey which at first has a weedy taste loses this on keeping.

Honey has on an average the following percentage composition: Carbohydrates, 81.2; water, 18.2; protein, 0.4; and ash, 0.2. The carbohydrates are made up of dextrose and lævulose in about equal proportion. Honey sometimes contains a little wax and some aromatic bodies, which give it flavor. The best and newest honey is clear and contained in a white comb. Older honey is of a yellowish tone, and sometimes darker. On standing, dextrose sometimes crystallizes out from liquid honey and renders it opaque or often thick. The composition of honey varies somewhat according to the food of the bees, their age, season, etc. It is a favorite article of diet, owing to its sweet taste and agreeable flavor. The actual food value depends upon the sugars (carbohydrates) present. Like all other carbohydrate foods, it is a source of energy. Honey has a fairly high fuel value, on an average—1520 calories per pound. It is, however, generally eaten for its flavor rather than for its true food value. To the ancients, who were unacquainted with sugar, it was of more importance than it is now. Taken in moderate quantity honey is wholesome and laxative, but persons suffering from digestive disorders often find that it aggravates their symptoms, and there are persons in health who, owing to some idiosyncrasy, cannot eat honey without distress. Its therapeutic action is probably not very great, but it is frequently employed in mixtures prescribed for allaying coughs and in various agreeable cooling drinks used in febrile and inflammatory affections. It should be mentioned that honey occasionally possesses poisonous properties, due to the flowers from which it was gathered. The poisonous honey of Trebizond is gathered from *Azalea pontica*. In America, poisoning has occurred from eating honey gathered from laurel (*Kalmia latifolia* and *Kalmia angustifolia*). Many other instances of poison honey are on record.

Honey is marketed in the comb and also extracted from it. The latter, sometimes called 'strained' honey, is frequently adulterated with commercial glucose. It is stated that much of the so-called honey which is sold contains none of the product gathered by the bee, and is entirely artificial. Of sixty-six samples of honey examined by the Massachusetts State Board of Health, fifteen were adulterated with cane-sugar or commercial glucose or both. One sample contained as high as 88 per cent. of commercial glucose. See also Bee.

HONEY-BADGER. See Badger.

HONEY-BEAR (so called from its fondness for honey). The Malayan sun-bear (*Ursus Malayanus*). One of the native names is Aswail. See Bear.

HONEY-BEE. See Bee; Bee-Keeping.

HONEY-BERRY. See Melicocca.

HONEY-BUZZARD, or Pern. A large hawk of the genus Pernis, peculiar in having the lores closely covered with feathers, which overlap one another like scales. The food of honey-buzzards consists, not of honey, but chiefly of bees, wasps, and their young, in quest of which these birds dig up the ground to get at the nests of the insects. They feed also partly on other insects, and less frequently on lizards, small birds, and the like. The several species are natives of the Old World.

HONEYCOMB (AS. *hunigcamb*, from *hunig*, honey + *camb*, connected with *comb*, OHG. *kamb*, *champ*, Ger. *Kamm*, comb, Gk. γόμφος, *gomphos*, OChurch Slav, *ząmbŭ*, Skt. *jambhya*, tooth). (1) See Bee; Honey. (2) In a gun, a condition of erosion which, eating into the rifling of the barrel, alters the direction of the projectile or bullet, and renders the firearm both dangerous and unserviceable. It is caused by the action of exploded gunpowder, and is a consideration of grave importance in the selection of ammunition for army purposes.

HONEY'COMB, Henry. A nom-de-plume of Leigh Hunt representing a professed descendant of Will Honeycomb, one of the *Spectator* editors.

HONEYCOMB, Will. A member of Addison's mythical *Spectator* Club. He is an authority on matters pertaining to the fashionable world.

HONEY-CREEPER. A bird of the family Cœrebidæ, a passerine family of tropical and subtropical America, especially abundant in the West Indies. They are small birds, four or five inches in length, but usually of very handsome plumage. The colors are frequently brilliant, blue being especially common. The bill is very slender, sharp, and often decurved, and the tongue is deeply bifid and penicillate. The honey-creepers are very closely allied to the American warblers, of the family Mniotiltidæ, so common throughout the United States. About forty species are known, one of which, the banana-quit, has occasionally strayed to Florida. They probe the corollas of flowers for the minute insects contained therein (not for the honey) and often hover before them like humming-birds, which some of them hardly exceed in size or fall below in brilliance. Consult: Gosse, *Birds of Jamaica* (London, 1847); id., *A Naturalist's Sojourn in Jamaica* (London, 1851).

HONEYDEW. A term applied to the sweetish secretion which under certain conditions drips from the water-pores of the leaves of some trees. It is a form of 'bleeding' which appears only when an abundant supply of moisture (reducing evaporation) and a high temperature permit the development of a considerable sap-pressure in the live cells. Some kinds of manna are the dried honeydew or the saccharine exudations of certain plants. Very generally this exudation, as it dries, coats the surface of leaves and branches with a clammy film, to which everything brought by the atmosphere adheres, thus closing the pores of the plant and impairing its health.

The name honeydew is often applied to a saccharine secretion of certain insects, notably the plant-lice, the flea-lice (Psyllidæ), certain scale-insects and white flies (Aleyrodidæ), and certain leaf-hoppers or tree-hoppers. Of the latter, *Proconia* (*Oncometopia*) *undata* secretes the most abundant supply, and is the cause of the phenomenon often described as 'weeping trees.' The honeydew secreted by all of these insects is frequently very abundant, giving the foliage and bark of trees a glistening appearance, and frequently attracting swarms of bees, ants, wasps, and other honey-loving insects. It is usually secreted from the anus, and with the tree-hoppers is ejected forcibly in a spray, or several small drops at frequent intervals, so that a tree in which they are very numerous appears to be 'weeping.' Honeydew affords a welcome nidus for the spores of certain of the smut-fungi, and an affected tree is likely soon to become black with smut. Thus an olive orchard in California or Southern Europe, the leaves of which turn black, will surely be found to be infested with a scale-insect (*Lecanium oleæ*) which secretes a quantity of honeydew. Orange and lemon plantations sometimes suffer great injury from the abundance of honeydew; and it has been proved a cause of very great loss in the coffee plantations of Ceylon. See APHID.

HONEY-EATER, or HONEY-SUCKER. A name sometimes given to some of the Oriental sun-birds (q.v.), but also the common name of a large family of birds nearly allied to these and peculiar to Australia and the islands of that part of the world. This family, Meliphagidæ, of the order *Passeres*, has a long curved sharp bill (see Plate of CREEPERS), not so slender as in humming-birds and sun-birds; the tongue terminates in a pencil of delicate filaments, the better to adapt it for sucking honey from flowers, or juices from fruits. These are a part of the food of the honey-eaters, but they also devour insects in great numbers. They are birds of elegant form, and generally of gay plumage. Most of them have a long and broad tail. They are vivacious and active, and keep up a continual chattering. Some 200 species of this family are known, arranged in about 25 genera. Examples are elsewhere described under BELLBIRD; BLOODBIRD; PARSON-BIRD; etc. Compare FLOWER-PECKER, and see CROSS-FERTILIZATION.

HONEY-GUIDE, INDICATOR, or MOROC. The popular name of a family of birds ranked in the vicinity of the barbets (q.v.) and woodpeckers (q.v.), but differing from these families in characters which show a slight approach to cuckoos, and also, in some respects, to creepers. About a dozen species are known, mostly natives of Africa, and found in almost all parts of it, but one species occurs in India, one in Malacca, and one in Borneo. They have acquired their name from guiding men to honey, a curious instinct prompting them to flutter near the traveler with frequent repetitions of a cry which resembles the syllable *cherr;* and it is said that if followed they almost always lead to a place where a bees' nest may be found. This story has been denounced as fabulous, but reliable observers vouch for its truthfulness. The birds are very fond of honey, and always reap a harvest after man has once opened up a bee-tree and taken what honey he wants. It is said that the Kaffirs never fail to leave a generous meal for the bird which has guided them to the tree. The honey-guides are small birds of dull plumage and rather stout bill. They generally build pensile nests, and lay white eggs, but some species are said to lay their eggs in the nests of other birds, as the European cuckoo and the cowbird do. See Plate of TROGON, HOOPOE, ETC.

HONEY-LOCUST, *Gleditschia triacanthos*, also known as sweet locust and black locust, and in Great Britain as three-thorned acacia. A lofty and beautiful tree of the natural order Leguminosæ, a native of the rich valleys from Ontario through the basin of the Mississippi. It is not found wild on the Atlantic coast of North America, although often planted for ornament in the vicinity of habitations. The flowers, which are small, greenish, and in spikes, usually have, when perfect, six stamens and one pistil, but are very generally unisexual. The leaves are twice pinnate, without terminal leaflets, and derive a peculiar gracefulness from the numerous small light-green shining leaflets. The tree is furnished with numerous sharp triple spines. The pods are long, flat, pendulous, often twisted; the seeds large, brown, and enveloped in a pulp, which, when the pod is ripe, is very sweet. Sugar has been made from it, and when fermented it yields an intoxicating beverage, in use among the American Indians. The honey-locust attains a height of 70 or 80 feet. The wood resembles that of the American locust-tree (see ACACIA), but is more coarse-grained. A variety is common in which the trees are nearly without thorns. The honey-locust is valuable for windbreaks, hedges, and other plantations. A second species, *Gleditschia monosperma*, is found from Kentucky and Missouri to the Gulf region and along the Atlantic from South Carolina to Florida. A third species, *Gleditschia Texana*, is a large tree in Texas, where it attains a height of more than a hundred feet.

HONEY-MAKING ANT. Any of several species of ants of the genus Myrmecocystus, inhabiting Colorado, Arizona, New Mexico, and Mexico. Like other ants, they live in colonies, in subterranean nests, the entrance to which is in a small raised mound. The honey is obtained at night from small galls on oak-leaves by foraging workers which come home considerably distended with honey. With the honey they feed the other workers and the young in the hill, and what is left over is communicated to a number of ants which simply serve as living receptacles. These live honey-bags cling to the roof of the cavern and move very little, and in time their abdomens become enormously distended. According to McCook, these living storehouses merely retain the honey until it is needed by the colony during the winter, when it is given out from the surcharged crops to feed the colony. An ant with similar habits, but of the genus Melophorus, has been described by Lubbock from Australia, and still another genus (Plagiolepsis) has more recently been discovered in South Africa. In Mexico these ants are eaten by the natives. Consult: McCook, *The Honey Ants of the Garden of the Gods*, etc. (Philadelphia, 1881); Comstock, in *Standard Natural History*, vol. ii. (Boston, 1884); Sharp, in *Cambridge Natural History*, vol. vi. (New York and London, 1900). See Ant.

HONEYMOON, The. A comedy in five acts, by John Tobin. It was produced after the author's death in 1805, and frequently reprinted. It is partly based on Shakespeare's *Taming of the Shrew*, and its style is strongly influenced by the Elizabethan dramatists.

HONEY-MOTH. See Bee.

HONEY-POD. See Mesquite-Tree.

HONEY-STONE. See Melilite.

HONEY-SUCKER. A bird of the family Meliphagidæ, or some related form, as the diamond-bird; an indefinite term for a somewhat indeterminate assemblage of Oriental and Australian birds. See Honey-Eater.

HONEYSUCKLE (AS. ***hunisuce, hunisuge***, from ***hunig***, honey + ***sūcan, sūgan***, OHG. ***sūger***, Ger. ***saugen***, Lat. ***sugere***, to suck), *Lonicera*. A genus of plants of the natural order Caprifoliaceæ. The species number one hundred or more, all of which are indigenous in the Northern Hemisphere. They are shrubs, often twining, and have the flowers either in whorls or in pairs. The calyx is short and five-toothed; the corolla, tubular-funnel-shaped, five-cleft, generally two-lipped; the fruit a three-celled and many-seeded berry. About half the species of Lonicera, as well as many hybrids, are in cultivation. The common honeysuckle, or woodbine of England (*Lonicera periclymenum*), is very abundant in woods and thickets in most parts of Great Britain. On account of its beautiful cream-colored flowers and their delightful fragrance, the honeysuckle is often planted in shrubberies. It is said to be the 'twisted eglantine' of Milton. Very similar to this is the perfoliate honeysuckle (*Lonicera caprifolium*), with whorls of paler flowers, and remarkable for having the upper leaves united so that an opposite pair form one leaf, through the middle of which the stem passes. This peculiarity is confined to the flower-bearing shoots, and does not occur in the young runners; it is also most perfect near the flower. This species is a native of the south of Europe, and much planted, as, although less fragrant than the common honeysuckle, it flowers earlier. There are numerous other species, natives of Europe, Siberia, and North America. The fly-honeysuckle (*Lonicera xylosteum*) is an erect shrub, a native of Europe and Asia, common in shrubberies. Its branches are not infrequently used in some parts of Europe for tubes of tobacco-pipes; and it is said to make good hedges in dry soils. The trumpet-honeysuckle (*Lonicera sempervirens*), a twining green shrub, called in America the coral honeysuckle, is a native of the Southern United States, often planted on account of its beautiful scented flowers, red on the outside and scarlet within. The Japanese honeysuckle (*Lonicera Japonica*) has become established in the eastern part of the United States, having escaped from cultivation. The berries of the honeysuckle are nauseous. The name honeysuckle is also given to shrubs very different from this genus, but of which the flowers abound in honey, as to species of Banksia in Australia, Diervilla, Aquilegia, etc., in the United States. *Rhododendron viscosum* is called swamp-honeysuckle in North America.

HONEYSUCKLE ORNAMENT. See Anthemion.

HONEYWOOD. The hero of Goldsmith's play *The Good-Natured Man*. He carries his generous folly so far as to resign to another the woman whom he loves and who loves him in secret. He is cured by a trick of his uncle, Sir William, who returns from abroad in disguise and exposes the hypocrisy of the other suitor.

HONFLEUR, ôɴ'flẽr'. A seaport town in the Department of Calvados, France, on the southern shore of the estuary of the Seine, seven miles from Havre, which lies on the opposite shore (Map: France, G 2). The town lost much of its former commercial importance, owing to the silting of its harbor, and the proximity of Havre. Since 1860 a floating basin and other harbor improvements have revived in a measure its waning commerce, and thriving fishing industries and a considerable trade in agricultural and animal products are carried on. The United States is represented by a consular agent. Population, in 1901, 9610. Honfleur, founded in the eleventh century, was of considerable strategical importance during the wars between France and England.

HONG-KIANG, hông'kyäng', or West River. See Si-Kiang.

HONG KONG, hông kông (Chin., Fragrant Streams). An island belonging to Great Britain, lying off the southeast coast of China, from which it is separated by a narrow channel (one-fourth mile at its narrowest), known as *Ly-e-Mun* or 'Carpfish Pass,' at the mouth of the Chu-kiang or Pearl River (Map: China, D 7). It is 75 miles southeast of Canton, and 38 miles east of Macao. Consisting of a range of granitic hills, it has little level land, its coast-line is very irregular, and its shores are steep and precipitous, but broken in many places, especially on the south coast, by deep inlets, the chief of which are Ty- (or Tai) tam, and Shek-pai Wan. It is between eight and nine miles long, from east to west, and nearly four miles in average breadth. Area, 20 square miles. The highest of six mountain peaks is Victoria Peak, with an elevation above sea-level of 1825 feet.

Geologically, Hong Kong is entirely of igneous origin, its prevailing rock being a gray rapidly disintegrating syenite upheaved and penetrated by porphyritic rocks and basaltic trap. The climate of the island is very trying to foreigners. The temperature seldom exceeds 93° F.; the minimum summer temperature is 75°; but the rainfall in certain seasons is sometimes excessive. The driest month of the year is December, and winter generally is the most delightful part of the year. The sanitary arrangements are good, but the Chinese quarter is sometimes visited by epidemics.

Notwithstanding the rocky character of the island and its generally barren appearance, Hong Kong possesses a rich and varied flora, which corresponds as a rule with that of Assam, Sikkim, and Nepal. Bentham, in his *Flora Hongkongensis* (London, 1861), enumerates 1056 species of flowering plants and ferns, divided into 591 genera and 125 orders. The fauna of the island includes only a few species of kingfisher, some singing birds and rock-pigeons; several varieties of snakes and lizards are found, and scorpions and centipedes abound. Insect life is more plentiful, and includes the mosquito, and a flying cockroach from an inch to an inch and a half or two inches long. Ants, both white and red, are abundant and destructive. Fish are plentiful in the surrounding waters, and a most wonderful variety is daily marketed.

The population consists principally of Chinese from the mainland. In 1897 it was 236,382, of whom only about 9000 were Europeans and Americans, and about 2000 East Indians and Japanese. The boat population numbers nearly 18,000. The great bulk of the population is found in the city of Victoria (called by the Chinese Kwan-tai-lo), which stretches for nearly four miles along the north shore, opposite the rocky peninsula called by the Chinese Chim-sha-tsui, but better known as Kow-lung ('nine dragons'), about 1½ miles distant. Here are the Government buildings and the great business houses and warehouses stretching along the water-front or perched in terrace-like rows on the steep hillsides, while far up on the Peak are many handsome bungalows. The buildings are substantial and imposing, and usually white. The more prominent are the Government House, City Hall, the Clock Tower, and the Anglican and Roman Catholic cathedrals. There are a public garden, several hospitals and cemeteries, two public libraries, many clubs, and a race-course. The streets, which are well made and well kept, are lighted with gas and electricity, and a plentiful supply of water is brought from Taitam by an aqueduct three miles long. The principal mode of conveyance is by jinrikisha in the more level parts, and sedan chairs, and these are now supplemented by an inclined plane and steam tramway two-thirds of the way to the Peak.

The harbor is capacious and safe, though exposed at times to typhoons. Four square miles of the peninsula of Kow-lung, which juts out from the mainland opposite and shuts in the harbor on the north and west, have been held by the British since 1860, under a lease obtained from the Governor-General of the two Kwang provinces of China. This was a base of operations during the Anglo-French punitive expedition to the north in that year, and since then has served as a sanatorium for the inhabitants and the troops stationed here. In 1898 an extension (to 376 miles) of the territory and a lease for 99 years were granted by the Chinese Government of Peking, and the peninsula now forms part of the Colony of Hong Kong. Here are dry docks and warehouses, some tanneries, etc., and here also is a station of the Chinese Imperial Maritime Customs, to check smuggling to the mainland of China. The hill of the Sung Emperors, with many historical associations, has been set apart as a recreation ground.

On the opposite side of the island are several small centres of population, the most important of which is Aberdeen, on the inlet known as Shek-pai Wan. Here are the sugar-refineries, ship-building yards, and foundries, etc., and two large graving-docks, the larger of which is 465 feet long, 80 feet wide, and has a depth on the sill of 24½ feet at spring tides. The chief industries of the colony are sugar-refining, cotton spinning and weaving, tanning, rope-making, ship and boat building; the manufacture of cement, drain-pipes, tiles, black-wood furniture, paper, bamboo, and rattan ware, etc. There is also a vermilion factory, and among the natives many hands are employed in wood and ivory carving, gold-beating, and the production of gold, silver, copper, iron, and sandalwood wares. Granite-quarrying is an important industry, and large quantities of dressed stone are exported annually. Hong Kong is a free port, and has no custom-house, and its commercial activities are chiefly distributive. The amount of business can only be inferred from the harbor-master's reports.

In 1898, 77,293 vessels, with a tonnage of 15,938,174 tons, entered port, and 79,629 vessels, of 17,265,780 tons, cleared. The trade of the port is chiefly with Great Britain and her colonies, the open ports of China, Japan, and the United States. The only commodity that pays a tax is opium. In 1898, 39.392½ chests were imported, and 37,828½ (= 43,142,525 catties) were exported. For trade purposes the Mexican and Hong Kong dollar are legal tender, and banknotes issued by the three great banks doing business here are in circulation.

The island was ceded to Great Britain by Ki-shin, the Chinese Commissioner, and was occupied by British forces in January, 1841, but this treaty was disallowed by the Emperor. In the following year, however, it was ratified by the treaty made at Nanking. On June 26, 1843, Hong Kong became by proclamation a separate colony, but continued to be governed by the Minister Plenipotentiary to China until 1857. Since that date its affairs have been administered by a Governor and an executive council composed of the Colonial Secretary, the officer commanding the troops, the Attorney-General, the Registrar-General, the Treasurer, and the Director of Public Works. There is also a legislative council of ten, of whom five are official, and five unofficial members. Of the latter three are nominated by the Crown—one of them must be a Chinese, one is nominated by the Chamber of Commerce, and one by the justices of the peace. Justice is administered by a supreme court, a police court, and a marine magistrate's court. In 1898 the police force consisted of 630 men, of whom 112 were Europeans, 226 East Indians, and 292 Chinese.

The public revenue is derived chiefly from land taxes and land sales, licenses, fees of court, the post-office, rent of Government property, light and harbor dues, opium, etc. In 1898 the total revenue was $2,918,159, and the expenditure $2,841,805, leaving a surplus of $76,354. The chief items of expenditure were: Public works, $428,828; military purposes, $519,274; police, $222,163; sanitary purposes, $101,613; education, $72,420; and jails, $57,954. The contribution for Imperial defense is £40,000 per annum. There is an Imperial garrison of several regiments, and a local volunteer artillery corps of over 100. The China naval squadron has its headquarters here, and the defenses are of great strength.

Education. In 1898 there were in the colony 109 educational establishments, with 8522 pupils, and of these 16 were Government schools. Queen's College, a Government institution, had 1344 students on the roll. Besides this there are Saint Paul's College, an Anglican institution, and many missionary and private schools. A number of ably conducted newspapers, both Chinese and English, are published. Consult: Mayer and Dennys, *Treaty Ports of China and Japan* (London and Hong Kong, 1867); Norman, *The Far East* (London, 1898).

HONI SOIT QUI MAL Y PENSE, ō'nē' swä kē mäl ē päns (Fr., Evil to him who evil thinks). An exclamation traditionally ascribed to Edward III. It is said to have been uttered at a ball when the King tied about his leg a garter which the Countess of Salisbury dropped while dancing. The words form the motto of the Order of the Garter (q.v.).

HONITON, hŏn'ĭ-ton. A market-town and municipal borough in Devonshire, England, on the Otter, 16 miles northeast of Exeter (Map: England, C 6). It is famous as the original manufacturing seat of 'Honiton lace.' Its manufacture was introduced by the Lollards during the reign of Elizabeth. The Vale of Honiton is famous for its butter. The town maintains its own water-supply. Population, in 1891, 3216; in 1901, 3270.

HONOLULU, hŏn'ō-lōō'lōō. The capital and commercial centre of the Hawaiian Islands, situated on the southern coast of the island of Oahu, in 21° 18′ N. latitude and 157° 55′ W. longitude, 2089 miles southwest of San Francisco (Map: Hawaii, D 2). It is wholly a modern town, surrounded by luxuriant fruit and ornamental trees and foliage, and is famed for its beauty and the loveliness of the region. It has a very healthful and mild climate, especially favorable for pulmonary troubles. The streets are well laid out, and the houses, although unpretentious, are rendered picturesque by their gardens. Honolulu has twenty-five miles of macadam streets. The area of its public parks is 194 acres. Among the public buildings are the royal palace, completed in the Italian style in 1882, the Government buildings, several churches, a museum containing interesting remains relating to the early history of the archipelago, a theatre, and a bank. There are 19 public schools and one high school, with a total attendance of 3345 pupils. Honolulu has several hospitals and a public library. There are manufactures of machinery. The town is equipped with a good water-supply, electric lighting and railway and telephone service. Its water-works plant, costing $1,300,000, and its electric-light plant are owned and operated by the Territorial Government. The city's municipal property had an assessed value in 1900 of about $2,500,000. The budget for that year balanced at $1,131,905. Over one-half of the expenditure was for construction and other capital outlay. There was spent on schools, $128,047. The harbor is well protected by coral reefs. The light from its lighthouse is visible eight leagues. Honolulu has regular steam communication with San Francisco (with which it is also connected by cable), Seattle, Vancouver, New Zealand, Sydney, and Japan. It forms the chief outlet for the trade of the entire archipelago. It is the seat of an Anglican and of a Catholic bishop, and of a number of European consular agents, as well as of the Government officials of the islands. As late as 1815 the present capital was a mere village. In that year, at the suggestion of John Young, an Englishman, then Governor of Hawaii, it was fortified, and in 1820 it became the capital of the archipelago. Population, in 1890, 22,907; in 1900, 39,306.

HONOR. In English feudal land law, an estate or lordship made up of several manors held under one baron or lord paramount. One court baron was often held for the whole estate, but regarded as the court of each manor. It was distinct from the great manor, although the name has been sometimes applied to the latter. See Manor.

HONOR, Knights and Ladies of. A fraternal benevolent society organized in Kentucky in 1877 for social and beneficial purposes. A distinguishing feature of this society is that men and women are admitted to membership on equal terms. The central authority is the supreme lodge, and the chief officer has the title of supreme protector. The Order has sixteen grand lodges and 1160 subordinate lodges, representing a total membership of 63,000. Since its organization it has dispensed benefits to the beneficiaries of deceased members to the amount of $19,000,000, and during the last fiscal year the disbursements for the same object amounted to $1,178,000.

HONOR, Knights of. A fraternal benefit society in the United States, organized at Louisville, Ky., June 30, 1873, by the institution of Golden Lodge No. 1, with seventeen charter members. Its objects are the social, moral, and intellectual elevation of its members, the establishment of bonds of fellowship between them, and the payment of death benefits to the widows and orphans of deceased members. It is incorporated under the laws of the State of Missouri, with headquarters at Saint Louis. The supreme lodge is the executive head of the Order, and is composed of the officers and of representatives from the various grand lodges, who meet annually and enact all laws governing the Order. The grand lodges are composed of representatives from subordinate lodges, are governed by officers elected by the representatives, and they control the subordinate lodges, in accordance with the laws of the supreme lodge. The Order has paid to beneficiaries since its organization $78,094,864. The benefits disbursed during the year ending in 1902 amounted to $3,074,649. There were in existence at the close of 1902 36 grand lodges and 1918 subordinate lodges, representing a membership of 55,733, with insurance in force of $96,852,500.

HONOR, Maids of. See Household, Royal.

HONO'RIA, Justa Grata. A daughter of Constantius III. and sister to Valentinian III., born about A.D. 418 in Constantinople. Living at Valentinian's court in Rome, she secretly invited Attila the Hun to marry her; but as he did not entertain the proposition, she sent another invitation, and Attila, accepting it, claimed with her a portion of the Empire. As Valentinian refused to accede to such a demand, Attila invaded Gaul. Honoria's fate is unknown.

HONO'RIUS. The name of four popes and one antipope.—Honorius I., Pope 625-38. He was born of a consular family in Campania. Of his early history little is known, except that he took an active part in bringing to a close the disputes which arose in Northern Italy about the controversy of the three chapters. (See Vigilius.) As Pope his name is connected with the history of the paschal controversy in Ireland, and with that of the early Anglo-Saxon Church, and his pontificate is particularly memorable on account of the Monothelite heresy. (See Monothelitism.) Honorius, misled, it is alleged, by a statement of Sergius, Patriarch of Constantinople, expressed himself in language which would appear to condemn the doctrine of two wills of Christ. In a decree of the sixth general council (Constantinople, 680-81) Honorius is anathematized in company with many others, of whose heterodoxy there can be no doubt. Catholic theologians, however, defend his orthodoxy, or at least point out that his case is not one of those in which infallibility is claimed by the Vatican decree. It was because Döllinger (q.v.) believed that the heresy of Honorius was irrefutably established that he could not conscientiously accept the dogma of Papal infallibility, because it was retroactive and implied that there never had been a pope who was heretical. This assertion in regard to Honorius was an important factor in the Old Catholic movement. He died in 638. Consult: Döllinger, *Fables and Prophecies of the Middle Ages* (New York, 1892); Pennacchi, *De Honorii Causa in Concilio Sexto* (Rome, 1870); Willis, *Pope Honorius and the New Roman Dogma* (London, 1879). The letters of Honorius are in Migne, *Patrologia Latina*, lxxx.—Honorius II. (Lambert, Cardinal of Ostia). Pope 1124-30. He recognized Lothair of Saxony as German Emperor (see Lothair III.), and was unable to crush the growing power of Count Roger of Sicily in South Italy. (See Roger II.) His letters are in Migne, *Patrologia Latina*, clxvi.—Honorius II. was also the title taken by Peter Cadalous, Bishop of Parma, antipope to Alexander II., 1061. He died 1073.—Honorius III. (Cencio Savelli). Pope 1216-27. He crowned Frederick II. as Emperor, tried in vain to institute a crusade, and confirmed the orders of the Dominicans and Franciscans. To him we owe the famous *Liber Censuum Romanæ Ecclesiæ*, in which the income of the Church of his day is detailed. It was reprinted by Paul Fabre, *Liber Censuum* (Paris, 1899, et seq.). Consult Tauge, *Die päpstlichen Kanzleiordnungen von 1200-1500* (Innsbruck, 1894). His works are in Horoy, *Medii Ævi Bibliotheca Patristica* (Paris, 1879-82). For his life, consult Clausen (Bonn, 1895).—Honorius IV. (Giacomo Savelli). Pope 1285-87. He was born in 1210, and notwithstanding his years when called to the Papal see, was very energetic. Consult his life by Pawlicki (Münster, 1896).

HONORIUS, Flavius (A.D. 384-423). Roman Emperor of the West from 395 to 423, second son of Theodosius the Great. He was born in 384. On the death of his father, A.D. 395, the Empire was divided into two parts, Honorius receiving the western half, with Rome as his capital, while his brother Arcadius received the eastern half, with Constantinople as his capital. Honorius, being only ten years old, was put under the guardianship of Stilicho (q.v.), who was all his life the *de facto* ruler of the Western Empire. Honorius first took up his residence at Milan, and later for the most part held his Court at Ravenna. In 398 he married Maria, the daughter of Stilicho. In 401 Alaric, King of the Visigoths, invaded Italy. Stilicho, who was then in Germany, marched against him, and a great battle was fought at Pollentia in 403 (or 402), followed by another encounter at Verona. Alaric, unable to withstand Stilicho, withdrew from Italy. Another irruption of barbarians, under Radagaisus, took place in 405, which was again repelled by Stilicho, who, nevertheless, lost the favor of his master, and was treacherously slain at Ravenna, A.D. 408. Alaric was not slow to take advantage of the opportunity afforded him. In the same year he invaded Italy, and besieged Rome, which escaped only on the payment of a heavy ransom; and in the following year he again besieged and took it, raising Attalus to the Imperial purple, but a little later deposing him. In 410 the Visigothic King again appeared before Rome and handed it over to be pillaged by his troops. The death of the invader in the same year again freed Italy. A new champion of the falling Empire arose in the person of Constantius, who suppressed the rebellions of Constantine, Jovinus, and Sallustius in the northern provinces, and of Heraclian in Africa. He was now appointed the colleague of Honorius in the consulship, and received in marriage the hand of Placidia, sister of Honorius, along with a share in the Empire, which he did not long enjoy, as his death took place a few months after. The Gothic and German tribes had for some time been slowly but steadily encroaching upon the Western Empire, and Honorius's reign saw Spain, Gaul, and Pannonia, some of the finest provinces, snatched from its grasp. He died August 27, 423.

HONORS, Military. See Salutes.

HONORS OF WAR. Stipulated privileges allowed a capitulating enemy; formerly a chivalrous appreciation of his valor, but in later times dictated almost entirely by the politic or economic phase of the question. Honors of war include the retention of arms, or standards, the granting of parole, and the general treatment of the surrendered troops and stores.

HON-SHIU, hŏn'shyōō'. The most important of the group of islands constituting the Empire of Japan. See Hondo.

HONTHEIM, hŏnt'hīm, Johann Nikolaus von (1701-90). A German Roman Catholic prelate and writer. He was born at Treves, January

27, 1701. He was educated in the Jesuit school of his native city, studied canon law at Louvain under the celebrated Van Espen, and afterwards taught at Treves and Coblenz, finding time to write at Treves two voluminous works on the history of the town, *Historia Trevirensis Diplomatica* (1750) and *Prodromus Historiæ Trevirensis* (1757). But his literary career is chiefly memorable for a theological essay, *De Statu Ecclesiæ et Legitima Potestate Romani Pontificis* (1763), which by the novelty and boldness of its views created an immense sensation in the theological world. The work was composed with a view to the reunion of Christian sects. The name of the author was for a long time unknown, the work being published under the pseudonym of Justinus Febronius (a name taken from that of Hontheim's niece, a canoness at Juvigny, who was called Justina Febronia), and the system of Church government which the work propounds has been called Febronianism (q.v.). The work, immediately after its appearance, was condemned by Clement XIII., as well as by many individual bishops. It drew forth a number of replies, the most important of which are those of Zaccaria (1767) and Ballerini (1768). Pius VI., in 1778, required from Hontheim a retraction of these doctrines. This retraction, however, was modified by a subsequent *Commentary*, published at Frankfort in 1781, to which, at the desire of the Pope, Cardinal Gerdil replied. Hontheim made full submission to the Church in 1788, and died in his ninetieth year at Montquintin, in Luxemburg, September 2, 1790. Consult Mejer, *Febronius* (Freiburg, 1885), a work biased in favor of Hontheim.

HONTHORST, hŏnt'hôrst, GERARD VAN (1590-1656). A Dutch painter, called 'Gherardo dalle notti,' from his frequent painting of night scenes. He was born at Utrecht, and at first studied under Abraham Bloemaert. At twenty he went to Italy, and was greatly influenced by Caravaggio; it was here that he gained his sobriquet. When he returned to Utrecht he was made the head of the Guild of Saint Luke (1623), and opened a large school. An invitation from Charles I. took him to England in 1628. There he decorated Whitehall. After this he went to The Hague, where he lived for several years. He painted a great number of pictures, and of all kinds, including portraits. All these show a good deal of power and coarse realism. The European galleries contain many of his works. A constantly repeated subject of his is a group of several persons with musical instruments, and one of these "Concerts" (1624) is at the Louvre. His brother, WILLEM VAN (1604-66), was also a painter, particularly of portraits, in the style of his brother.

HONVÉD, hôn'väd (Hung., land-defenders). The name given in Hungary under the earlier kings to the national champions. With the disappearance of these the word, too, disappeared; but in the summer of 1848 it was revived, and applied first to those Hungarian volunteers dispatched to the south against the Serbs, and subsequently, when the war with Austria commenced, to the whole patriotic army. Since the reconstruction of the Austro-Hungarian monarchy the name honvéd, or honvédség, has been given to the militia of the Hungarian portion of the Empire.

HOOBLY, hōō'blĭ. A town in the Province of Bombay, British India. See HUBLI.

HOOCH, hōG, or **HOOGH,** PIETER DE (1632-81). A Dutch painter, born at Rotterdam. According to the latest biographers of this artist, he was the pupil of Nikolaas Berchem at Amsterdam, but he seems to have been more influenced by Rembrandt than by Berchem. About 1654 he went to Delft, and in 1655 was elected a member of the Guild of Saint Luke. In 1667 he was still at Delft, but at this date all positive trace of him is lost. There is some evidence that he lived in Amsterdam after this, and still later at The Hague. It is curious that such a great painter as de Hooch should not have been appreciated until our own time, but such is the case. His works are now greatly prized. The list of them includes about eighty, principally in the museums of Holland; the National Gallery of London possesses three fine interiors with figures, and there are several in the Louvre and some in private collections. He generally treated domestic scenes out of doors, where his mastery of light is unequaled by any painter of his country.

HOOCHENOO, hōō'chê-nô. A spirituous liquor concocted by the natives of Alaska, and named from one of the tribes of Indians.

HOOD, ALEXANDER (1758-98). An English navy captain. His first voyage was aboard the *Romney* with his cousin, Captain Samuel, afterwards Viscount Hood, but in 1772 he went round the world on the *Resolution* with Captain Cook. Between 1776 and 1783 he was on active service in the West Indies, but was appointed (1797) to command the *Mars* of the Channel fleet, and was one of the captains put ashore by the mutineers off Saint Helens and Spithead. The next year, when his frigate was engaged in the famous duel with the *Hercule*, Captain Hood was mortally wounded at the moment of victory.

HOOD, EDWIN PAXTON (1820-85). An English Congregationalist. He was born in London, December 18, 1820, educated privately, and became a Congregational clergyman in 1852. He held various charges, and from 1880 to his death in Paris, June 12, 1885, he was pastor of the Falcon Square Church, Aldersgate Street, London. He rendered conspicuous service in raising the funds for the Royal College for Incurables, his pamphlet, "The Palace of Pain" (1885), having brought in £2000. He was the author of numerous volumes, several of which are still read, especially his *Lamps, Pitchers, and Trumpets: Lectures on the Vocation of the Preacher* (1867), a racy volume on homiletics and the history of preaching, and *The World of Moral and Religious Anecdote* (1870). His agreeable book-making powers were exhibited in the biographies of John Milton (1852), Andrew Marvell (1853), Emanuel Swedenborg (1854), William Wordsworth (1856), Thomas Binney (1874), Isaac Watts (1875), Thomas Carlyle (1875), Christmas Evans (1881), Robert Hall (1881), and Oliver Cromwell (1882).

HOOD, JOHN BELL (1831-79). An American soldier, prominent on the Confederate side during the Civil War. He was born in Owingsville, Ky.; graduated at West Point in 1853; and remained in the United States Army until 1861, when he resigned to accept a commission in the Confederate service. During the first years of the war he took part in the Virginia campaigns, where his gallantry gained him the rank of major-general. At Gettysburg his division was stationed on the extreme right of the Confederate line, and took part in some of the most desperate fighting of that bloody battle. In September, 1863, he was sent to the aid of General Bragg in Tennessee, and took part in the battle of Chickamauga, September 19th-20th, where he lost a leg. The next spring he again took the field and was made a lieutenant-general in Johnston's army. During the campaign by which this general sought to impede Sherman's advance on Atlanta, Hood was engaged in several battles, and on May 25, 1864, his corps was attacked by Hooker at New Hope Church. On July 17th he was given the temporary rank of general, and was appointed to succeed Johnston in command of the Army of the Tennessee. Sherman was exultant at this change, for he knew that Johnston's wearing tactics would now give place to a policy which would enable him to make good use of his superior fighting strength. On July 20th was fought the battle of Peach Tree Creek, as a result of which Hood was compelled to withdraw into the fortifications about Atlanta, and two days later the battle of Atlanta followed his flank movement toward Decatur. On July 28th he attacked the Federal forces, but was again compelled to withdraw into his fortifications. After another engagement at Jonesboro, on September 1st, he abandoned Atlanta, which was entered by Sherman on the 2d. Hood, after operating for several weeks along the line of Sherman's communications, and moving westward into northern Alabama, crossed the Tennessee River about the end of October and began to move northward through Tennessee against General Thomas. After his attack on the Federal forces under Schofield at Franklin had been repulsed (see FRANKLIN, BATTLE OF), he proceeded to Nashville, where he found Thomas stationed with a force about equal to his own. Thomas was not prepared at the outset, and for nearly two weeks the two armies faced each other. At last, on December 15th, Thomas ordered the attack. The Confederates fought desperately, but were forced back all along the line. That night Hood re-formed his army and the next day awaited the Federals on the Overton Hills. Owing to his strong position, he succeeded in repelling the first assault, but the second was more successful, and soon the Confederates were driven in utter rout. As a military force Hood's army disappeared, and on January 23, 1865, at his own request, he was relieved of his command. After the war he became a commission merchant in New Orleans and president of the New Orleans branch of the Life Association of America. He wrote a book entitled *Advance and Retreat: Personal Experiences in the United States and Confederate States Armies* (1880), and wrote a number of articles for *Battles and Leaders of the Civil War* (New York, 1887).

HOOD, MOUNT. A peak of the Cascade Range (q.v.), on the western border of Wasco County, Ore. (Map: Oregon, D 4). It is 50 miles east by south of Portland, whence it is reached by rail to Hood River, 66 miles, and thence by stage to the base of the northern glaciers. It has an altitude of 11,934 feet; there are no formidable obstacles to its ascent, and the summit commands an extensive and magnificent view.

HOOD, ROBIN. The hero of a group of English ballads, which represent him as an outlaw, dwelling in Sherwood forest, Nottinghamshire, or in Barnsdale, a woodland district in the West Riding of Yorkshire. The earliest known mention of him is in the second version of *Piers Plowman* (about 1377), where Sloth says he "knows rymes of Robyn Hood" (*Skeat*, Passus v. II. 401, 402). The oldest extant ballad of which he is hero is "A Geste of Robyn Hode," assigned to about 1400. This poem, consisting of 456 four-line stanzas, is in magnitude almost an epic. Among succeeding ballads, of which Professor Child collected thirty-nine, are "Robin Hood and Guy of Gisborne," "Robin Hood and the Monk," and "Robin Hood's Death." As early as the last half of the fifteenth century Robin Hood became a popular character in the semi-dramatic celebrations of May-day, both in England and in Scotland, and later in the regular drama, as in Ben Jonson's beautiful pastoral *The Sad Shepherd*. Robin is the ideal outlaw, courteous, liberal, and reverent. Skillful with the bow, he shoots the King's deer, but he loves the King. He takes from the rich clergy their superfluous goods, but what he does not need himself he gives to the poor. He is chivalrous toward all women, and reveres the Virgin Mary. His chief foe is the sheriff of Nottingham. With him is a numerous band. There are Little John, Scathlock, or Scarlock, Friar Tuck, Maid Marian, Much the Miller's Son, and several others. In his illness Robin goes to a prioress, who is his cousin, to be bled. She allows him to bleed to death.

Unsuccessful attempts have been made to prove the real existence of Robin. True, his career as eventually developed has all the details of authentic history; but these were taken from the ballads themselves, or from semi-historical personages, as Hereward the Wake, and Wallace, and applied to Robin. Others have tried to connect the surname Hood with Woden, the chief of the Norse gods, or with Hödr (warrior), another Norse divinity. It is now rather thought to be a variant of Hodeken, an elf in Germanic folktales. Robin is of course a diminutive of Robert. Robin Hood then seems to have been at first only an elf of the woods, about whom later gathered typical adventures of the outlaw. Robin Hood is the hero of a comic opera by Reginald De Koven (q.v.), and a late drama by Tennyson, *The Foresters*, has Robin Hood as its main character. Consult: Child, *English and Scottish Ballads* (Boston, 1883 et seq.); *Bishop Percy's Folio*, ed. Hales and Furnivall, vol. i. (London, 1867); Ritson, *Robin Hood* (London, 1795, new ed. 1885); and for an attempt to prove the existence of Robin Hood, Hunter, *The Great Hero of the Ancient Minstrelsy of England* (London, 1852).

HOOD, SAMUEL, Viscount (1724-1816). An English admiral, born at Thorncombe. He embarked at first as captain's servant, then as seaman, was midshipman on Rodney's ship (1743), was lieutenant at twenty-two and post-captain at thirty-two. During his retirement from active service (1778-80), he was commissioner of the dock yards at Portsmouth, but went to sea again under Admiral Rodney, as next to him in rank upon the North American Squadron. Hood took part in several famous naval battles in 1781-82, notably that of Dominica, for his share in which he was granted an Irish peerage. He was elected member of Parliament for Westminster in 1784, was made a Lord of the Admiralty four years later, took command of the British fleet in the Mediterranean in 1793, and in 1796 was made a viscount. He was specially strong as a tactician, and his junior officer, Horatio Nelson, acknowledged his indebtedness to him in that particular, and upon his retirement wrote: "The fleet must regret the loss of Lord Hood, the best officer, take him altogether, that England has to boast of; great in all situations which an admiral can be placed in."

HOOD, Thomas (1799-1845). An English poet and humorist, born in London, May 23, 1799. After leaving school he was placed in a merchant's counting-house, but his health failing, he was sent to Dundee. At the age of nineteen he returned to London, and studied the art of engraving with his uncle. In 1821 he became assistant sub-editor of the *London Magazine*. He contributed to it considerable verse, and made the acquaintance of its brilliant staff, which included De Quincey, Hazlitt, and Lamb. His first separate publication was entitled *Odes and Addresses on Great People*, written in conjunction with J. H. Reynolds (1825). In 1826 he published *Whims and Oddities*, of which a second series appeared during the following year. In 1829 he began the *Comic Annual*, and continued it for nine years. The same year he edited the *Gem*, one of the popular annuals, contributing to its pages his striking poem entitled "Eugene Aram's Dream." In 1824 Hood married the sister of J. H. Reynolds, and in 1831 he went to reside at Wanstead, in Essex, where he wrote his novel *Tylney Hall* (1834). While there he suffered from the failure of a publisher. In 1835, now weakened in health, he went to the Continent, where he remained five years, first at Coblenz, on the Rhine, and then at Ostend. He, however, continued his *Comic Annuals*, started *Hood's Own* (1838), containing a portrait and reminiscences, and made Smollett's *Humphrey Clinker* a framework for some humorous sketches called *Up the Rhine* (1839). In 1840 he returned to England, and began to write for the *New Monthly Magazine*, of which he became editor the following year. Here appeared "Miss Kilmansegg," his best comic poem. Withdrawing from this magazine toward the close of 1843, he started *Hood's Magazine*, January, 1844; and in the same year collected his fugitive pieces under the title of *Whimsicalities*, which were illustrated by Leech. By Christmas he took to his bed, which he never again left. During his last illness Sir Robert Peel conferred on him a pension of £100 a year, which he transferred to his wife. He died on May 3, 1845, and was buried in Kensal Green Cemetery.

Hood takes a high place both as humorist and as serious poet. He is great at once in comedy and in pathos, and he sometimes curiously mingles and combines both. As a punster he is supreme: he connects far-separated words and ideas by the most subtle analogies, and sends them loose. Much of his comedy, however, is verbal and shallow, and will be soon forgotten. It is as a poet that Hood will be remembered. His "Eugene Aram's Dream," "Song of the Shirt," and "Bridge of Sighs" are among the most perfect poems of their kind in the English language. Consult: *Memorials*, ed. by his daughter (London, 1860); *Literary Reminiscences* in *Hood's Own*, first series (ib., 1838); Eliot, *Hood in Scotland* (Dundee, 1885); *Works*, ed. by son and daughter (10 vols., London, 1869-73); *Poems*, ed. by Ainger, in "Everley Series" (12 vols., ib., 1897); and *Haunted House*, with memoir by Austin Dobson (ib., 1895).

HOODED CROW (so called from the marking on the head). A true crow (*Corvus cornix*) of the north of Europe, also called in England 'dun,' or 'gray,' and 'Royston' crow, and in Scotland 'hoodie.' The head, fore parts, and wings are glossy black; the remainder of the body, ash-color; the bill and feet, black. It is slightly migratory, and retreats southward in winter from the most northerly parts of Europe and Siberia when the other crows go south. Its general habits are those of the carrion-crow, with which it interbreeds extensively, so that some naturalists believe the two birds to be varieties of one species. See Newton, *Dictionary of Birds* (London and New York, 1896).

The 'hooded crow' of India is a smaller species (*Corvus splendens*) of similar appearance. It is tame to the point of being a nuisance to Europeans wherever it is numerous. Hardly a station or camp in British India, it is said, is free from a crowd of these feathered thieves. They have the amusing habit of building their nests of the wire from discarded soda-water bottles.

HOODED MERGANSER. See Merganser.

HOODED SEAL. A large seal (*Cystophora cristata*) inhabiting the coasts of Greenland, and North America as far south as the United States. It also occurs on the coasts of Sweden and Norway and in the Arctic Ocean. It is found generally in the icy islands, or floating ice-fields, in the open sea, and visits the land in April, May, and June. About two inches from the extremity of the upper jaw there is a cartilaginous crest, increasing in height as it passes backward to the back part of the head, where it is about seven inches high, and has a longitudinal depression in the middle, about an inch deep. This crest is an elongation of the septum of the nose, and the true nostrils open on either side of it. It is covered by a muscular hood clothed with fur. The whole apparatus is probably defensive, but may be accessory to the organ of smell, and, as the fishermen suppose, may serve as a reservoir of air while the animal is under water. The hood is wanting in the females and young. The hooded seal is polygamous and brings forth its young on the ice. It has a voice resembling the bark and whine of a dog, and when attacked weeps copious tears.

HOODED WARBLER (so called from the marking on the head). One of the most beautiful and active of the American 'fly-catching' warblers. (See Warbler.) It is olive-green above and yellow below, with the head, neck, and breast deep black. It inhabits in summer the Eastern United States, where it frequents thickets and undergrowth, and makes a soft, cup-like nest in low bushes. Its systematic name is *Sylvania mitrata*. See Colored Plate of Wood-Warblers with Warbler.

HOODIE. See Hooded Crow.

HOOF (AS. *hōf*, OHG. *huof*, Ger. *Huf;* connected with OChurch Slav. *kopyto*, hoof, or with Skt. *śapha*, Av. *safa*, hoof). The exterior horny covering of the foot of many animals. The healthy soundness of the horse's foot is mainly preserved by permitting it to grow uninjured by the rasp and knife; its toughness is secured, and undue dryness and evaporation prevented, by smearing daily the crust, sole, and frog with a little glycerin, or a mixture of a pound of lard and a quarter of a pound each of tar, honey, beeswax, and glycerin melted together. Softness and brittleness of the hoof, which are common sources of cracks and corns, may be remedied by the regular use of such dressings, by placing the feet for several hours daily in thick woolen swabs, kept cool and moist by frequent applications of cold water, and by encouraging a more healthy growth of horn by occasional mild blisters round the coronary band. Cracks, or sand-cracks, as they are termed, mostly occur among horses much upon the road, cause lameness, and constitute unsoundness. When serious and recent, poulticing, thinning away of the crust about the crack, and perfect rest are essential. After the earlier heat and tenderness are removed a hot iron should be drawn at right angles to the crack, both above and below, so as to separate the diseased from the sound horn. Waxed thread or fine wire should be wound round the hoof, and a sound growth of horn stimulated by a blister round the coronet. The horse's hoofs are too hard and coarse to be employed for the making of the better class of combs and buttons, for which purpose the hoofs of cattle are extensively employed. They are, however, largely used by manufacturers of prussiate of potash and artificial manures. See CORN.

HOOFT, hōft, PIETER CORNELISZOON (1581-1647). A Dutch poet and historian, born in Amsterdam. He was the son of an Amsterdam burgomaster; received a thorough education in the classics, and made an extensive journey through France, Germany, and Italy. After his return in 1601 he studied jurisprudence at Leyden, and was appointed bailiff of Muiden. At the Castle of Muiden and in Amsterdam he gathered around him the most celebrated artists, poets, and scholars of the day, known in Dutch literary history as the 'Muiden circle.' He is considered one of the first, if not the first, of Dutch prose writers, despite his too frequent Latinisms. His letters are particularly charming, and are free from this failing. Among his poetical works are the pastoral play in Italian style, *Granida* (1615), the tragedies *Gheraert van Velzen* (1613), *Theseus en Ariadne* (1614), and *Baeto* (1626). His chief historical works are *Hendrik de Groote* (1626); *Rampzaaligheden der verheffinghe van huize Medicis* (1636); *De Nederlandsche Historien* (2 vols., 1642). The latter is one of the classics of Dutch literature and Hooft's chief work. He also translated Tacitus, of whom he was an imitator, and he is often called the 'Dutch Tacitus.' His *Poems* were published in 1636 (new complete edition, ed. P. Leendertz, Haarlem, 1864). His erotic verse is particularly notable as being the first of this genre to appear in Dutch literature. Consult his *Breven*, edited by J. van Vloten (Leyden, 1855-57).

HOOGEVEEN, hō'ge-vān'. One of the fen colonies of the Netherlands, situated in the Province of Drenthe (Map: Netherlands, E 2). It has extensive peat-mines and shipyards. Population, in 1889, 11,702; in 1899, 11,924.

HOOGLY, hōōg'lĭ. One of the arms of the Ganges. See HUGLI.

HOOGSTRAETEN, hōg'strä'ten, SAMUEL VAN (1627-78). A Dutch painter, born at Dordrecht. He was the pupil of his father, Dirk van Hoogstraeten (1596-1640), an artist, and afterwards of Rembrandt. He began as a portrait painter in the manner of his last master, but afterwards was influenced by the Italian school and did landscape and still life. In this style he is reminiscent of Pieter de Hooch. In 1651 he went to Vienna and Rome, and also paid a visit to England (1653). He is the author of an *Introduction to the High Art School* (1678), which is full of admiration for Rembrandt. His paintings include: "A Lady Walking in a Court," "Old Jew," "Inner Court of a Fortress," and "A Sick Girl."

HOOGSTRATEN, hōg'strä'ten, JAKOB VAN (c.1454-1527). A Belgian priest and inquisitor, born at Hoogstraeten. He entered the Dominican Order and became doctor and professor of theology, and prior of the Order at Cologne. He is widely known through his connection with the celebrated humanist Reuchlin. Hoogstraten proposed to burn all the Jewish books, on the ground that they contained nothing but calumnies against Christ. Reuchlin persuaded the Emperor Maximilian against this course, and thereby incurred the enmity of the inquisitor, who subjected him to every persecution. Thereupon there ensued the polemic war called by Erasmus "The beginning of the Lutheran tragedy," and this was the occasion of the famous *Epistolæ Obscurorum Virorum*. Hoogstraten's epitaph, as composed by his enemies, is a severe arraignment of the man's character—*Hic jacet Hoogstratus viventem ferre patique quem potuere mali, non potuere boni.* Among his treatises are *Destructio Cabbalæ contra Reuchlinum* (1518), and *De Christiana libertate Tractatus V. contra Lutherum* (1526).

HOOK, JAMES CLARKE (1819—). An English painter, born in London. He studied in the Royal Academy, and in 1846 won a scholarship by his picture "Rizpah," and went to Italy. In 1860 he became an academician. His English pastoral subjects are most popular, though his first works were nearly always of Italian scenes. Among his paintings are: "Mother Carey's Chickens," "Breton Fishermen's Wives," "Morning After a Gale," "Market Girls," "Luff, Boy," and "A Surrey Stream." His work is characterized by strong brilliant color and fresh realistic treatment.

HOOK, THEODORE EDWARD (1788-1841). An English wit and novelist, son of James Hook, a musical composer, born in London, September 22, 1788. Educated mostly at private schools, he attended for a short time Harrow and Oxford. Between 1805 and 1811, while yet a boy, he produced, either single-handed or in conjunction with his father, thirteen comic operas and melodramas, all of which were popular at the time. His ready wit, sparkling humor, and wonderful powers of improvisation made him the delight of society; and having pleased the Prince Regent, he was appointed (1813) Accountant-General and Treasurer at Mauritius, with a salary and allowances amounting to nearly £2000 a year. These offices he held till 1818, when the discovery of a deficiency of £62,000 in the military chest caused him to be arrested and sent to England, and his effects seized and sold. The peculation, it afterwards appeared, had been committed by a clerk, who committed suicide. On obtaining his liberty, Hook supported himself by writing for the newspapers and magazines, and on the establishment of *John Bull*, a weekly Tory newspaper, in 1820, he was appointed its editor. From his connection with this bold, clever, and virulent print he derived during its prosperous state fully £2000 a year. In August, 1823, he was arrested for his debt to the Crown, and his property sold. He remained within the rules of the King's Bench till May, 1825, when he was released from custody. In 1824 appeared, in three volumes, the first series of his *Sayings and Doings*, which yielded him £2000. A second series followed in 1825, and a third in 1828, for each of which he seems to have received about 1000 guineas. Several other three-volume novels followed in rapid succession—*Maxwell; Love and Pride; Gilbert Gurney*, which contains a sort of autobiography of himself; *Jack Brag; Births, Deaths, and Marriages;* and *Gurney Married*. He died August 24, 1841. Hook's novels are sketches of contemporary manners, and as such they possess value. Exceedingly popular in their own day, they are now difficult reading, for the witty thrusts are no longer obvious. Hook himself was regarded by his later contemporaries as a jester. He is the original of Lucian Gay in Disraeli's *Coningsby*, and is introduced in *Vanity Fair* as Mr. Wagg. The better side of his character is given by Lockhart in the *Quarterly Review*, vol. xxii. (London, 1845). Consult: *Humorous Works* (London, 1873), and Barham, *Life and Remains of Hook* (London, 1849; revised 1899).

HOOK, Walter Farquhar (1798-1875). An English dean and ecclesiastical historian. He was the nephew of the humorist Theodore Hook, and the son of Dr. James Hook, Dean of Worcester. He was born in London, graduated M.A. at Christ Church, Oxford, in 1824, and received the degree of D.D. in 1837. He took holy orders in 1821, and after holding curacies in the Isle of Wight and in Birmingham, was Vicar of Holy Trinity, Coventry, from 1828 to 1837, when he became incumbent of Leeds. Here by his tact and resourcefulness he overcame strenuous opposition on the part of Dissenters and among the working classes, who objected to compulsory Church rates, won great popularity; and in 1859, when he became Dean of Chichester, left Leeds richer by 21 new churches, 29 vicarages, and 27 schools. From 1827 he was chaplain-in-ordinary to George IV., William IV., and Victoria, on the accession of the latter preaching in the Chapel Royal his famous sermon, "Hear the Church," of which 28 editions, numbering over 100,000 copies, were sold in a short time. Its great vogue was due to the original enunciation of the fact that the Anglican Church of the sixteenth century was a reformed church and a return to the early English Church founded by the Apostles. At Chichester he wrote his most important work, *Lives of the Archbishops of Canterbury* (12 vols., 1860-76). Besides sermons and devotional works he published: *A Church Dictionary* (1842; 14th ed. 1887); and *Dictionary of Ecclesiastical Biography* (8 vols., 1845-52). His memory is perpetuated in Leeds by a handsome Gothic memorial church, completed in 1880. Consult Stephens, *Life and Letters of Dean Hook* (London, 1878).

HOOKE, Nathaniel (1690?-1763). A British historian, born in Ireland. He studied law, but practiced literature, beginning with a translation of the *Life of Fénelon* (1725), and *An Account of the Conduct of the Dowager Duchess of Marlborough* (1742), taken down from her dictation, and ending with a *Roman History from the Building of Rome to the Ruin of the Commonwealth* (4 vols., 1738-71), the latter half of which was not published till after his death, while the latest edition (6 vols.) came out in 1830. Hooke was the friend of many prominent characters of his time, including Pope.

HOOKE, Robert (1635-1703). An English physicist. He was born on the Isle of Wight, and was educated at Westminster School, and at Christ Church, Oxford. He assisted Boyle in the construction of his air-pump, and in 1662 was appointed curator of experiments to the Royal Society. In 1664 he became professor of geometry in Gresham College, London. In 1667 he was appointed city surveyor, though his model for rebuilding the city of London after the great fire of 1666 had not been adopted. From 1677 to 1682 he was secretary to the Royal Society. Though a man of extraordinary acuteness of perception and inventive genius, Hooke did not always enjoy the esteem of his contemporaries, owing to his peevish and excitable temper. He claimed priority—in many cases justly—to some of the most important discoveries and inventions of the time, and authorities admit that he was the first to recognize clearly that the problem of planetary motion should be treated as a purely mechanical one. He undoubtedly grasped the fundamental principle upon which Newton subsequently constructed the theory of gravitation; he failed, however, to develop it mathematically. Among his important inventions were the use of the balance spring for the regulation of watches, and many useful improvements in physical and astronomical instruments. His publications include: *Micrographics* (1666); the *Lectiones Cutlerianæ* (1678-79); and his *Posthumous Works* (1705).

HOOKE, William (1601-78). An English clergyman, domestic chaplain to Oliver Cromwell. He was born in Southampton, was educated at Oxford, and after one charge in Devonshire went to America, and took charge of a church at Taunton, Mass. (1637-44). His next congregation was in New Haven, but he returned to England in 1656, and as his wife was Cromwell's cousin, the Protector made him master of the Savoy Hospital in Westminster, also his own chaplain. Some of Hooke's sermons were published, as well as his *New England's Tears for Old England's Fears* (1640).

HOOK'ER, Mount. One of the loftiest peaks of the Rocky Mountains in Canada, situated near the boundary of British Columbia and Alberta (Map: Northwest Territories, F 4). It has an estimated elevation of 15,700 feet.

HOOKER, Joseph (1814-79). A distinguished American soldier. He was born at Hadley, Mass., November 13, 1814; graduated at West Point in

1837 in the same class with Jubal Early and Braxton Bragg, and was assigned to the First Artillery. He served in Florida and on the Maine frontier in 1837-40, and was adjutant at West Point in 1841, and of his regiment from 1841 to 1846. During the Mexican War he served as aide to Gens. Persifer F. Smith, Thomas L. Harmar, William O. Butler, and Gideon J. Pillow; participated in the principal battles both of the northern and of the southern campaign, receiving the brevets of captain, major, and lieutenant-colonel for gallantry; became captain in 1848; was assistant adjutant-general to the Pacific Division in 1849-51, and resigned from the army February 21, 1853. From that date until the outbreak of the Civil War he was in turn farmer, civil engineer, and colonel of California militia. He was appointed brigadier-general of volunteers, May 17, 1861, and in March, 1862, was assigned to the command of the Second Division, Third Corps, Army of the Potomac. On May 5, 1862, he became major-general of volunteers, and at the battle of Williamsburg, Va., fought on that day, handled his division with skill and valor. He was active throughout the Peninsular campaign, and subsequently was conspicuous in the battles of Bristoe Station, the second battle of Bull Run, and Chantilly. In the Maryland campaign, as commander of the First Corps, he took part in the battles of South Mountain and Antietam, being wounded in the latter engagement. He was appointed brigadier-general in the Regular Army September 20, 1862.

In November, 1862, he was placed in command of the Fifth Corps, and at the battle of Fredericksburg (q.v.) commanded the centre grand division of the Army of the Potomac, comprising the Third and Fifth Corps. On January 26, 1863, he was assigned by President Lincoln to the command of the Army of the Potomac. His first act was to refit and reorganize the army. In a few months he had recruited depleted regiments, supplied them with new clothing and equipments, weeded out incompetent officers, armed, equipped, and organized the mounted troops in a single corps, and in other ways had infused new life into the army.

In his new command General Hooker failed, however, to show those qualities on the battlefield which had distinguished him as a corps and division commander. With the greater part of his army he advanced against General Lee, who then had a force half the size of his own, and who was stationed south of the Rappahannock, with the intention of attacking him in flank and rear and crushing him at one blow. His plans were somewhat deranged by high water and the failure of his cavalry under Stoneman to cut Lee's communications. While in position around Chancellorsville his right flank was surprised by the Confederate General Jackson, one corps was thrown into confusion, and after a protracted struggle, lasting from the 2d to the 4th of May, in which both armies suffered great losses, the Army of the Potomac was forced to recross the Rappahannock. While the fighting was hottest, on May 3d, Hooker was stunned, a pillar against which he was leaning having been struck by a cannon-ball. The disastrous result was largely due to his vacillation and his inability to cope with an emergency. (See CHANCELLORSVILLE, BATTLE OF.) After the battle Hooker and Lee stood for some time facing each other across the Rappahannock, and shortly after Lee had started on his aggressive campaign which terminated in the battle of Gettysburg, Hooker broke up his camp and followed. The pressure of public opinion in the North, however, combined with friction between General Hooker and General Halleck, and growing lack of confidence in Hooker on the part of President Lincoln caused him to offer his resignation, and on June 28, 1863, General Meade succeeded him. The Government then gave him command of the Eleventh and Twelfth Corps, later combined to form the Twentieth Corps (Army of the Cumberland), and sent him (September 24, 1863) to reënforce Rosecrans at Chattanooga. On November 24th, in the so-called 'battle among the clouds,' at the head of his new command, he led a charge in the face of the Confederate artillery and infantry posted on Lookout Mountain. For his conduct on this occasion he was, on March 13, 1865, brevetted major-general in the Regular Army. He further distinguished himself under Sherman at Dalton and Resaca, and in the attack on Atlanta. At his own request (July 30, 1864), he was placed on waiting orders September 28th, when he was put in command of the Northern Department. On July 8, 1865, he was given charge of the Department of the East, and soon afterwards of the Department of the Lakes, with headquarters at Detroit, where he remained until 1867. A paralytic attack occasioned his retirement from active service (October 15, 1868), with the full rank of major-general in the Regular Army. General Hooker was a man of handsome physique and of great personal magnetism. He died at Garden City, L. I., October 31, 1879.

HOOKER, JOSEPH DALTON (1817—). A noted British botanist and traveler, second son of W. J. Hooker (q.v.). He was born at Glasgow, where he obtained the degree of M.D. in 1839. He immediately thereafter renounced the pursuit of medicine for that of botany, and joined the Antarctic expedition of the *Erebus* and *Terror*. When he returned, in 1843, he brought 5340 species of plants, which, with those discovered on the voyages of Captain Cook and other travelers, are discussed in six quarto volumes under the titles of *Flora Antarctica*, *Flora Novæ Zelandiæ*, and *Flora Tasmaniæ* (1844-60), works which won him an eminent position in science. In 1847 he undertook a three years' expedition to the Himalayas, upon which he made large collections, which, joined with those of his friend, Dr. Thomson, of the Botanical Gardens, Calcutta, aggregated nearly 7000 species. His *Himalayan Journals* (2 vols., 8vo, 1852 and 1854) contain the narrative of this expedition, and the *Rhododendrons of the Sikkim-Himalaya* (1849-51) illustrate the most remarkable additions which he made on this occasion to ornamental garden plants. With Dr. Thomson he undertook a *Flora Indica* (vol. i., 8vo, 1855), the first volume of which, containing only a few orders, remains a fragment. Half of the volume is occupied with a dissertation on botanical geography, a department of science to which he paid special attention in various works. He afterwards again undertook a *Flora of British India*, which was completed in 1874. In 1871 he made an expedition to Morocco, ascended the Great Atlas, the summit of which had never before been reached by a European, and brought back a valuable collection of plants. In 1855 he was appointed assistant director at Kew Gardens, and, on the death of his father in 1865, director. He was president of the British Association in 1868, was appointed Companion of the Bath in 1869, and served as president of the Royal Society from 1872 to 1877. In the latter year he was knighted Commander of the Star of India. In the list of scientific memoirs published by the Royal Society, he is recorded as the author of 58 independent numbers and the joint author of 18 others. His *Students' Flora of the British Islands* is chiefly characterized by the record of the geographical distribution of the species. His great work, *Genera Plantarum,* undertaken in conjunction with his friend, George Bentham, commenced to appear in 1862. Among his other voyages, accounts of which appear in various books and journals, may be mentioned one to Palestine and Syria in 1860, and another to the Rocky Mountains, California, in 1877.

HOOKER, Richard (c.1553-1600). An English clergyman, author of the most famous existing treatise on the constitution of the Church of England. He was born at Exeter, in the year 1553 or 1554, of poor parents. He was a grave, bashful, and quiet boy, diligent in his studies, and quick at learning. His early progress was so rapid that his uncle, John Hooker, was induced to aid him in pursuing his education further. With additional help from John Jewel, Bishop of Salisbury, who afterwards became his patron, he was enabled to go to Oxford, where he entered Corpus Christi College in 1567. He became a scholar of Corpus Christi in 1573, was admitted to the degree of Master of Arts in 1577, and the same year became a fellow. The range of his learning was wide, and by no means confined to theology. From the age of nineteen he served as tutor, and in 1579 he was summoned, in an emergency, to deliver the Hebrew lecture, which he did so much to the satisfaction of the authorities that he continued to perform this duty so long as he remained at Oxford. For some unknown reason—perhaps through Puritan influence—he was once temporarily suspended from college, but honorably restored within a month. In 1582 Hooker took holy orders, and not long after married, Walton says, to his own sorrow. This marriage put an end to Hooker's quiet and congenial Oxford life. He was now obliged to seek a parish. He received the modest living of Drayton-Beauchamp, in Buckinghamshire (1584), where he lived, rather uncomfortably, for about a year. At the end of that period his fortunes were bettered by his being made Master of the Temple, London, over the head of a Puritan, Walter Travers, who was already reader there.

Hooker's London life was troubled with ecclesiastical controversy, which he disliked, yet which he would not attempt to avoid when once it was forced upon him. His colleague, Travers, represented that party in the Church of England which desired the adoption of Genevan ideas and usages, whereas Hooker stood for the episcopal establishment. These opposite views were reflected in the preaching at the Temple. "The forenoon sermon spake Canterbury, and the afternoon Geneva," was the current saying. Presbyterianism was either more popular, or else it had the better presentation, for we hear that the congregation "ebbed in the morning" (when Hooker preached), and "flowed in the afternoon" (to hear Travers). The Puritan champion was at last silenced by Archbishop Whitgift, but the discussion was continued in print. Hooker was so deeply stirred by the question at issue that he determined to give it exhaustive treatment in book form, and at once entered upon the preparation of what became the celebrated *Laws of Ecclesiastical Polity.* To carry out his design a change of scene was necessary, and Hooker sought once more the quiet of a country parish, and found it at Boscombe, in Kent (1591). At the same time he was made a minor prebend of Salisbury, which added to his income without increasing his labor. In Boscomb Hooker wrote the first four books of the *Laws*, and they were published in 1594. The following year he removed to Bishop's Bourne, in Kent, where he spent the remainder of his life. Book V. of the *Laws* appeared in 1597, and there is reason to believe that the other three books were written here, although they were not published. There were to be eight books in all, according to Hooker's original plan. The *Laws* were hailed as the best defense of the Anglican position ever written. Visitors sought the author out in his retreat, but he himself was all unconscious of the important position he had come to occupy. His days were passed in quiet labor, and he continued to fulfill every duty of his parish with conscientious fidelity until his death, November 2, 1600, at the comparatively early age of forty-seven.

Hooker's reputation rests upon his writings, not upon his preaching. In personal appearance he was not prepossessing, and his manner in the pulpit was not effective. But as the author of the *Ecclesiastical Polity* he stands in the front rank of English men of letters. This work is a monument of literary style, in the formative period of English prose, besides being the most important contribution to the subject of Church government in the language. We have the first five books precisely as Hooker wrote them. The fate of books vi. to viii. in their completed form is shrouded in mystery. Walton relates that the manuscript was destroyed by Puritan relatives of Mrs. Hooker, but that the earlier rough draughts were preserved. From these, long afterwards, the seventh and eighth books were printed. What claimed to be a sixth book appeared in 1648, along with the eighth, but most of this probably does not belong to the *Laws* at all. The whole eight books were republished, with a life of Hooker by Izaak Walton, in 1666, since which time they have passed through many editions. In substance the *Ecclesiastical Polity* is a treatise on Church and civil government. Hooker's conception of the origin of the State resembles the 'social compact' theory of more recent times. The Church he holds to be simply the English State, looked at from the religious point of view. He defends the Established Church system, with all its ceremonial; but he does this with singular moderation, and he invariably accords courteous treatment to his opponents. In discussing the theories of Presbyterians and Independents, he points out what he believes to be their fundamental defects, and he defends the episcopal theory on Scriptural and rational grounds, as well as because of its antiquity and practical success. All succeeding writers on the English Church have built upon the foundations which Hooker laid.

Hooker's *Works* (including the *Ecclesiastical Polity*, the controversy with Travers, a *Discourse of Justification*, and a few *Sermons*) were published by John Keble (4 vols., 1836). This edition superseded all previous ones. It was reissued, with improvements (7th ed.) by Dean Church and Canon Paget, in 1888. Consult Walton, *Life of Richard Hooker*, prefixed to most editions of his works (Oxford, 1836).

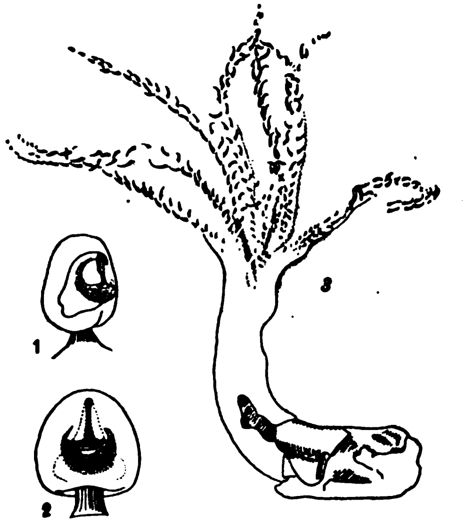
HOOKER, THOMAS (c.1586-1647). A New England clergyman, the real founder of the Colony of Connecticut. He was born at Markfield, Leicestershire, England, and was educated at Emmanuel College, Cambridge, where he took the degree of B.A. in 1608, and that of M.A. in 1611. After holding a fellowship for some time at Cambridge, he became, about 1620, rector of a little church at Esher, in Surrey. In 1626 he accepted a lectureship at Chelmsford, Essex, where he soon won renown as an eloquent preacher, but by this very prominence attracted the attention of Laud, then Bishop of London, to his Puritanism. In May, 1629, he appeared before Laud, and was threatened by him with action before the Court of High Commission, and in the following year, upon being cited to appear before that tribunal, he left England and settled in Holland. In Holland he remained for three years, preaching in the English churches at Amsterdam, Delft, and Rotterdam. In 1633 he sailed for New England, on the same ship with John Cotton (q.v.), settling in Newtowne (Cambridge) in October of that year, and being admitted a freeman in the following spring. He was chosen pastor of the first church at Newtowne on October 11, 1633, and soon afterwards became one of the most influential clergymen in the Colony. It was he who in October, 1635, argued with Roger Williams before the General Court. There was something of a spirit of rivalry, not only between the people of Newtowne and Boston, but between their principal pastors, Hooker and Cotton. As early as May, 1634, the people of Newtowne complained to the General Court that they did not have room enough, and sought either for permission to extend their boundaries or remove to a new location, and in July they sent a small party into the Connecticut Valley to find a suitable place. The matter was temporarily adjusted by the extension of the town limits, but the spirit of unrest remained, and in 1636 Mr. Hooker and his church, with large delegations from the churches at Dorchester and Watertown, removed into the Connecticut Valley. The Newtowne church members established themselves at Hartford, but the influence of Hooker extended also to the towns of Windsor and Wethersfield, which were settled by others who had followed his lead into the new country. But it is not only as the leader and moving spirit of the new settlements that Hooker deserves to be known, but as the inspirer, if not the actual author, of the Fundamental Laws which delegates from the several river towns adopted for their government in 1639. In January, 1639, Hooker accompanied John Haynes, the first Governor of Connecticut, to Boston to confer with Winthrop concerning a proposed confederation of the New England settlements to provide for their mutual defense against the Dutch, the Indians, and the French. The year 1643 saw the result of their labors in the successful organization of the 'United Colonies of New England,' the first attempt at federal government in America. Hooker published a great many sermons, and also: *The Soule's Preparation for Christ* (1632); *The Soule's Implantation* (1637); *The Soule's Ingrafting into Christ* (1637); *The Soule's Exaltation* (1638); *The Soule's Vocation* (1638); *An Exposition of the Principles of Religion* (1630); *The Saint's Guide* (1645); *A Survey of the Summe of Church Discipline* (1648), a defense of the New England churches which had great influence in the development of Congregationalism in America. Consult: Walker, *Thomas Hooker*, in the "Makers of America Series" (New York, 1891); Walker, *History of the First Church in Hartford* (Hartford, 1883); Johnston, *Connecticut*, in the "American Commonwealths Series" (Boston, 1878); *Johns Hopkins University Studies*, vol. vii. (Baltimore, 1889); Cotton Mather, *Magnalia Christi Americana* (London, 1702).

HOOKER, Sir WILLIAM JACKSON (1785-1865). A celebrated English botanist. He was born at Norwich, and studied branches of natural history as a pastime during his youth. In 1811 he published his first work, *Journal of a Tour in Iceland*, of which a second edition was demanded in 1813. From that time forward he was constantly busy in the publication of botanical works. His investigation of the British Jungermanniæ and mosses led to his appointment to the chair of botany in Glasgow University, where he lectured with marked success until 1841, when he became director of the royal gardens at Kew. Here his pronounced executive ability wrought wonders. The garden, which at that time consisted of eleven acres, was extended to 45, in addition to which a park of 240 acres was added; the 10 old conservatories were replaced by 25 much larger ones of more modern construction; in conjunction with Henslow, he founded the most complete museum of botany in the world; and by his enormous correspondence with and ready aid to botanists throughout the realm, Kew Gardens became the distributing point of hundreds of useful plants, which were sent there in collections and then shipped to colonies for testing. Through his efforts Great Britain has largely extended her commerce in products of the soil. Accompanying his official duties he was collecting for his private herbarium, and writing books on botany which at the time of his death numbered about one hundred volumes. His herbarium was purchased by the nation after his death. His name was enrolled in the lists of all scientific societies at home and abroad, and on account of his scientific acquirements he was knighted in 1836. Among his works may be mentioned: *Monograph of the British Jungermanniæ* (1812-13); *Muscologia Britannica* (1818); *The British Flora* (1830), a work which has gone through seven editions; *A Century of Orchidaceous Plants* (1848); *Icones Plantarum*, in 10 volumes (1837-60); *British Ferns* (1862); *Garden Ferns* (1862).

HOOKER, WORTHINGTON (1806-67). An American physician, born in Springfield, Mass. He graduated at Yale in 1825, and in medicine at Harvard in 1829, and practiced in Connecticut until 1852, from which time until his death he was professor of the theory and practice of medicine in Yale. His principal works are: *Physician and Patient* (1849); *Homœopathy: an Examination of the Doctrines and Evidences* (1852); and

Rational Therapeutics (1857). His *Child's Book of Nature* achieved a deserved reputation and is still widely used.

HOOK-SQUID. A squid of the family Onychoteuthidæ, allied to the common squids, but having the eyes destitute of any covering of skin. The two longer arms, or 'tentacles,' and sometimes the shorter arms, bear suckers, each inclosing a powerful hook, which is retractile, like the claws of a cat. Hook-squids are found in the Sargasso Sea, in the Polynesian seas, etc., and are much dreaded by swimmers and divers, as they are sometimes six feet or more long.



HOOKS OF A HOOK-SQUID.

1. Side view of a sucker, showing a half-concealed hook. 2. Front view of same. 3. A fossil hook-squid (*Acanthoteuthis speciosa*): impression of arms, traceable by the preserved hooks, in the lithographic slates of Eichstädt, Bavaria.

HOOLE, John (1727-1803). An English translator and dramatist, born in Moorfields, London. He had little education, was too nearsighted to become a watchmaker like his father, so entered the India House as a clerk (1744), was made auditor of Indian accounts, then principal auditor. He is known to letters because of his acquaintance with John Scott, and his biography of him, and for his acquaintance with Johnson, for whom he organized (1781) a city club, and whom he attended in his last illness. His poetical style was smooth and artificial. Hoole's works are: the translations, *Tasso's Jerusalem Delivered* (last edition, 1819), *Dramas of Metastasio* (1767), *Tasso's Orlando Furioso* (1791), and *Tasso's Rinaldo* (1792), which were all severely criticised by Scott, Southey, and Lamb; his own dramas, *Cyrus*, from Metastasio's *Ciro Riconosciuto* (1768); *Timanthes*, an imitation of Metastasio's *Demofonte* (1770); and *Cleonice*, said to have been corrected by Johnson (1775); the life of Scott, already mentioned, which was prefixed to Scott's *Critical Essays;* and a monody on *The Death of Mrs. Woffington* (1760).

HOO′LOCK. The white-browed gibbon (*Hylobates hoolock*) of Northeastern India, where it leads an active life among the hill forests. It is frequently kept captive, and proves a docile, cleanly, and interesting pet. The name is a native imitation of their whooping call, heard most frequently at sunrise. See Gibbon.

HOONOOMAN, ho͞o′no͞o-män. The sacred monkey of India. A better spelling of the word is Hanuman (q.v.).

HOOP-ASH. See Hackberry.

HOOP′ER, John (c.1495-1555). An English prelate and martyr. He was born in Somersetshire about 1495, and educated at Oxford. He became a Cistercian monk, and when the monasteries were dissolved went to London to live. He was converted to Protestantism, and, advocating his new views, had to flee to the Continent (1540), and spent some time in Switzerland. Some time after the accession of Edward VI. he returned to England (1549), and became a preacher in London. In 1550 he was appointed Bishop of Gloucester, but his objections to wearing the episcopal vestments caused some delay in his consecration. In 1552 he received the bishopric of Worcester *in commendam.* On the commencement of Mary's reign in 1553 he was committed to the Fleet, where he remained for 18 months, being frequently examined before the Council, was condemned as a heretic, and burned at the stake at Gloucester, February 9, 1555. He was the author of numerous sermons and controversial treatises, of which a collected edition appeared at Oxford (1855).

HOOPER, Johnson J. (c.1815-1863). An American humorist. He was born in North Carolina, removed early to Alabama, edited a newspaper and practiced law there, and was secretary of the Provisional Confederate Congress. In 1845 he published the *Adventures of Captain Simon Suggs,* one of the raciest books of its time, descriptive of a gambling sharp of the Southwest in the 'flush times.' His *Widow Rugby's Husband and Other Tales of Alabama* (1851) is less successful.

HOOPER, William (1742-90). An American jurist and signer of the Declaration of Independence, born in Boston and educated at Harvard. He studied law with James Otis, and practiced very successfully in North Carolina, where he ably assisted the Provincial Government in suppressing the disturbances of 1770, and was elected to the Legislature in 1773. There he became a leader, and, a year later, was elected to the Continental Congress, from which he resigned in 1777. He was one of the Federal judges appointed to adjudicate the territorial dispute between Massachusetts and New York.

HOOPESTON, ho͝op′ston. A city in Vermilion County, Ill., 100 miles south of Chicago; on the Chicago and Eastern Illinois and the Lake Erie and Western railroads (Map: Illinois, E 3). It is the seat of Greer College, established in 1891, and has McFarren and other public parks. The city is in a fertile agricultural region, and manufactures horseshoe nails, cans and canning machinery, and canned goods, among its establishments being two of the largest sweet-corn canning factories in the United States. In 1877 Hoopeston received a city charter, still in operation, which provides for a mayor, elected biennially, and a council. The water-works are owned and operated by the municipality. Population, in 1890, 1911; in 1900, 3823.

HOOPING COUGH. See Whooping Cough.

HOOPOE (obsolete *hoopoop,* reduplication of *hoop,* Fr. *huppe,* OF. *huppe,* hüpe, from Lat.

upupa, hoopoe). One of a small and singular group of birds of the warmer parts of the Old World, which take both their common and systematic names (genus Upupa, family Upupidæ) from their cry. In this family the bill is long and slender, the wings of moderate size or short, the legs short, the toes long, and the claws strong and curved. The common European hoopoe (*Upupa epops*) is an African bird, visiting in summer most parts of Europe and Asia, but rare in Great Britain. It is about the size of a blue jay; its plumage exhibits a fine mixture of white, buff, and black, and it has a large crest of two parallel rows of feathers. Its strange appearance and habits have caused it to figure largely in European legend and folk-lore. It gets its food chiefly on the ground, and its peculiar notes are said to be made by striking the bill on the ground as the note is uttered. The nest is made in a hole in a tree or wall, and the eggs are white. The hoopoes were formerly thought to be related to the crows, but it is now generally admitted that their nearest relatives are the hornbills, although they are apparently so different. An extensive account of the curious and interesting traits of this bird is given in the *Royal Natural History*, vol. iv. (London, 1895). See BIRD for other authorities. See Plate of TROGONS, HOOPOE, ETC.

HOOPOE.

WOOD-HOOPOE. The birds of the family Irisoridæ, which are found in South Africa, are nearly related apparently to the Upupidæ, and are known as wood-hoopoes. They are arboreal, have a glossy blackish plumage, no crest, and a long graduated tail. They are said to be noisy and restless birds, and to climb about on trees like woodpeckers. Like the true hoopoes, they emit a strong, disagreeable smell.

HOOPS, HOOP-SKIRT. See CRINOLINE.

HOOPSNAKE. A small snake (*Abastor erythrogrammus*) of the South Atlantic States, foolishly feared by the negroes, who say it will put its tail in its mouth, stiffen its body, and roll along like a hoop, aiming to let go of its sting-tipped tail and dart it into the first person it meets. Similar stories are told of a closely related species, the wampum-snake (*Farancia abacura*), common in swampy ground in the South; and both are called 'horn-snakes.' In fact both species are perfectly harmless, and spend most of their time beneath the ground, burrowing deeply into the soil. The former is blue-black above, marked with three red lines, and flesh-colored below, with black spots; while the latter is uniform bluish black above and banded with red on the abdomen.

HOORN, hōrn. A seaport of the Netherlands, in the Province of North Holland, situated on the Hoornerhop, a bay of the Zuyder Zee, 25 miles northeast of Amsterdam (Map: Netherlands, D 2). It is a typical old Dutch town, and has several quaint buildings, among them the Harbor Tower, the town hall, and the court-house. other notable edifices are the museum and the Groote Kerk (great church), the latter with a monument to Admiral Floriszoon. Hoorn was formerly one of the richest towns in Holland, the great nets for the herring fishery being employed here as early as 1416. It has now a considerable trade in dairy products, and also some shipbuilding. Hoorn is the birthplace of the navigator Willem Schouten, who named Cape Horn after his native town. Population, in 1889, 11,033; in 1899, 10,714.

HOORNE, HOORN, HORN, or **HORNES,** PHILIPPE DE MONTMORENCY-NEVELE, Count of (c.1518-68). A Flemish statesman and soldier, born at Nevele. Trained to arms under Charles V., he distinguished himself in the war against the Schmalkaldic League and later accompanied Philip II. on his travels in Germany, Italy, Spain, and England. At the battle of Saint-Quentin (1557) Hoorne did brilliant service as commander of the artillery. Later he accompanied Philip to Spain, but in 1561 returned to Brussels, as councilor of State. In this capacity he sided with Egmont and the Prince of Orange in opposition to Cardinal Granvella and the Spanish party. He urged on Margaret of Parma to a policy of concession, and having been sent to Tournay to reëstablish order there, he showed a spirit of toleration which won for him the regard of the patriotic party, but increased the animosity of the Ultramontanes. The failure of Egmont (q.v.) and Hoorne to throw in their lot with the Spanish party was, however, fatal. When the Duke of Alva arrived the two noblemen were treacherously seized, and after an illegal trial before the Council of Blood, were executed in the great square of Brussels, June 5, 1568. Besides the contemporary chronicles, consult: Juste, *Le comte d'Egmont et le comte de Hornes* (Brussels, 1863); and the popular account by Schiller, "The Trial and Execution of Counts Egmont and Horn," in his *Historical Works* (London, 1847); also the histories by Motley and others, cited under NETHERLANDS.

HOO'SAC MOUNTAINS. A spur of the Green Mountain Range in west Massachusetts, extending 16 miles north and south on the east side of the valley of the Upper Hoosac (Map: Massachusetts, A 2). The Hoosac railway tunnel (see TUNNEL), which pierces Hoosac Mountain, is the largest tunnel in America.

HOOSAC RIVER. A river of Vermont and New York States, rising in Berkshire County, Mass., and after a north and northwest course flowing into the Hudson, 15 miles north of Troy (Map: Vermont, A 10). In New York State it is known as the Hoosick.

HOOSE, hōōz *or* hōōs. A cattle disease due to the presence of parasites in the bronchial tubes.

HOO'SICK FALLS. A village in Rensselaer County, N. Y., 27 miles northeast of Troy; on the Hoosac (Hoosick) River, and on the Boston and Maine Railroad (Map: New York, G 3). It has extensive manufactures of agricultural implements, cotton and woolen goods, shirts, paper, and paper-making machinery. Settled in 1688, Hoosick Falls was incorporated first in 1827. Under a charter of 1884, revised in 1890, the village is governed by a president, chosen every three years, and a board of trustees, elected from their respective wards on a general ticket. Population, in 1890, 7014; in 1900, 5671.

HOOSIER (ho͞o'zhēr) **FROG.** See Mink-Frog.

HOOSIER SCHOOLMASTER, The. A novel by Edward Eggleston (1875), one of the first successful attempts to picture the rude surroundings of the pioneers of the Middle West. The story became very popular and was the author's only successful novel.

HOOSIER STATE. Indiana. See States, Popular Names of.

HOOVE, or **HOVEN.** See Bloat.

HOP (from MDutch *hoppe*, Dutch *hop*, OHG. *hopfo*, Ger. *hopfen*, hop, of doubtful origin), *Humulus Lupulus*. A perennial plant which belongs to the Urticaceæ, or nettle family. The single species, a native of America and England, where it is often found growing wild upon trees and shrubs, has given rise under cultivation to many varieties. The hop is a diœcious climbing vine with rough stems and heart-shaped, three to seven lobed leaves. The pistillate flowers are the hop of commerce, used mainly in the manufacture of beer. Hop culture is not general like the culture of cereals, but is confined to certain areas, comparatively limited in extent, which on account of soil and climatic conditions are especially suited to the production of the crop. The principal hop-producing regions of the United States are New York and the Pacific Coast States. Wisconsin also produces a small quantity. In Europe hops are grown for the market in England, Bohemia, Germany, France, and Belgium. The hops from Kent in England and from Saaz and Auscha in Bohemia have long been considered of the finest quality throughout the world. In general, the hops are known in the European markets by the name of the locality in which they were grown. This serves as an indication of their comparative quality and value.

The hop may be grown on a variety of soils, but it always requires a well-drained subsoil. It succeeds best on a moist, sandy loam. Soil conditions are generally considered the most important factor in determining the quality of the crop. In preparing land for hops it is plowed deeply and brought to a fine tilth. The hop is propagated by cuttings made from the underground stems which the plant sends out near the surface of the ground. These cuttings are made and set out in the spring. In the United States the plants are usually placed about seven feet apart each way, but in European hop-fields the distance is about four feet. In this country one male plant is grown per hundred or so, but in Europe as a rule only female plants are grown, as the presence of seeds in the hops injures the flavor of certain beers made from them. The vines are either trained on poles or on wire trellises. The latter method is gradually displacing the system of training on poles. During the growing season the soil is cultivated to keep it mellow and retentive of moisture and for the purpose of killing the weeds. Harvesting is done by hand, and forms the hop-grower's busy season, as the hop deteriorates when exposed too long to the weather after it is ripe. The yield varies from 1000 to 3000 pounds per acre. When the hops are harvested they are immediately cured by air-drying under cover or by drying in kilns constructed for that purpose. The cured product is pressed into bales of about 200 pounds each and is shipped in this form to distant markets. In Europe hops are generally shipped in large sacks without being baled. By the *American Agriculturist*, the crop of 1900 was estimated at 208,000 bales; 1901, 210,000; 1902, 195,500. The largest crop recorded was that of 1894, which was estimated to be 320,000 bales.

The valuable principle of the hop is a yellowish aromatic, resinous substance called lupulin, which has been found to contain two preservative or soft resins (oleoresins), and a non-preservative or hard resin. The preservative resins are the most valuable, since they are particularly unfavorable to the growth of lactic ferments, but not to the true yeast of beer. The deterioration of hops caused by exposure when mature, or by excessive drying, consists in the waste of the lupulin. To fulfill the requirements of the brewer the product must be a well-ripened hop, properly dried and with the resin and other qualities unimpaired.

HOP.

HOP-APHIS. See Hop-Louse; Hop-Insects.

HOPAT'CONG, Lake. A picturesque body of water in Sussex County, N. J., 50 miles northwest of Jersey City. Stages connect it with Hopatcong railway station, 4 miles distant. The lake is 8½ miles long, 3½ miles wide, and lies in a well-wooded fir and pine district, 725 feet above sea-level. The Musconetcong River drains it from the southwest into the Delaware. There are numerous hotels and boarding-houses on its shores, and it is a favorite summer resort.

HOPE, Alexander James Beresford- (1820-87). An English politician and author, son of Thomas Hope and stepson of William Carr, Viscount Beresford. He was educated at Harrow and at Trinity College, Cambridge; served in Parliament from 1841 to 1852; was reëlected in 1857; and from 1868 to his death represented Cambridge University. An independent Conservative, he opposed the abolition of Church rates, the legalization of marriage to one's deceased wife's sister, and, especially, the Reform Bill of 1867. In the debate on the last measure he broke lances with Disraeli, calling him the 'Asian mystery,' and getting recognition of his Dutch ancestry and poor delivery in Disraeli's allusion to 'Batavian graces.' A High Churchman and deeply devoted to the English Church and to its control by the State, Hope bought, in 1844, Saint Augustine's Abbey, Canterbury, as a missionary college, built All Saints' Church, in London, and wrote on religious liberty, at the time of the excitement over Roman aggression, in the *Chronicle*, and later in the *Saturday Review*, being closely associated in both with John Douglas Cook. Hope was president of the Royal Institute of British Architects (1865-67), of the Architectural Museum, and of the Ecclesiological Society. His works include: several works on Church politics; *A Popular View of the American Civil War* (3d ed. 1861); and a successful novel, *Strictly Tied Up* (4th ed. 1886).

HOPE, ANTHONY. See HAWKINS, ANTHONY HOPE.

HOPE, Sir JAMES (1808-81). A British admiral, born in Edinburgh. He was educated in the Royal Naval College, Portsmouth, and when fourteen years old went as midshipman on a frigate bound for the West Indies. In five years he was promoted lieutenant and by 1830 had reached the rank of commander, having by that time made voyages to the Mediterranean and the East Indies. He saw service in North and South America (1833-45), and after opposing the Russians in the Baltic for two years was created rear-admiral (1857), and commander of the Chinese squadron (1859-62). In 1859 he made a gallant attempt to enforce the ratification of a treaty the Pekin Government had entered into with France and England. He lost ships and men and was himself severely wounded, but returned to the attack the following year and was successful (1860). From 1863 to 1867 he commanded in North American waters and the West Indies, and for three years (1869-72) was in charge at Portsmouth. He was made an admiral in 1870, chief naval aide-de-camp to Queen Victoria in 1873, and was retired in 1878, but was created honorary admiral of the entire fleet a year later.

HOPE, THOMAS (c.1770-1831). An English author and virtuoso. He belonged to a rich family of merchants, Scotch by descent, who had settled in Amsterdam. While still a youth he traveled extensively in Southern Europe and in the East, and collected many drawings, chiefly of buildings and sculptures. After 1796 he made England his home. He first attracted attention by the decorations which he bestowed on the interior of his mansion in Duchess Street, Portland Place, London, a description of which appears in his book *Household Furniture* (1807). In 1809 he published *Costumes of the Ancients* and *Architecture of Theatres*. Three years afterwards appeared *Modern Costumes*, and in 1819 *Anastasius, or Memoirs of a Modern Greek at the Close of the Eighteenth Century*. Published anonymously, this last work was ascribed to Lord Byron, who said that he had wept because he did not write it. It is a brilliant romance describing adventures and manners in the East. After his death appeared *An Essay on the Origin and Prospects of Man* and *An Historical Essay on Architecture*.

HOPE, THOMAS CHARLES (1766-1844). A Scotch professor of chemistry, born in Edinburgh. He graduated at the University there in 1787 and for the following eight years was professor of chemistry and assistant in medicine at the University of Glasgow. He returned to his alma mater to be associated with Prof. Joseph Black in chemical instruction, became his successor in 1799, and retained the chair till a year before his death. He was specially skilled in experimental work, and the results of his two most important discoveries are contained in a paper read before the Royal Society of Edinburgh, *An Account of a Mineral from Strontian, and of a Peculiar Species of Earth which It Contains* (1793), and in *Experiments on the Contraction of Water by Heat*, published by the Edinburgh Royal Society (1805). Professor Hope instituted a prize in chemistry (1828), but he was averse to permitting his students to take a practical part in his experiments.

HOPE COLLEGE. An institution of learning, situated at Holland, Mich. It was organized by Dutch colonists in 1857 as an academy, and chartered as a college in 1866 under the auspices of the Reformed Church in America. The Western Theological Seminary was founded in 1869. The college is coeducational and had in 1902 121 preparatory, 65 collegiate, and 17 theological students, an endowment of $270,191 and an income of $20,424. At the same time the library contained 10,000 volumes. Besides the ancient languages, instruction is given in French, German, Dutch, Italian, and Spanish. The degree of Bachelor of Arts is conferred.

HOPE'DALE. A communistic settlement, founded in 1841 by a society under the leadership of Rev. Adin Ballou, in the town of Milford, Worcester Co., Mass. The chief aim of the founder was to restore the original ideals of Christian life, rather than to reorganize society economically. A farm of 238 acres with mill sites was purchased by the society, organized as a joint-stock company. The community consisted of twenty-eight persons, who observed strictly the rules of communism. As the community increased in numbers, these rules were somewhat relaxed. A board of trustees at first controlled the industries of the community; but later the several branches were farmed out to individuals. The community was not a success financially, nor was social harmony long maintained. In 1854 it had reached its highest point, embracing about two hundred members. Agriculture and several branches of manufacture were carried on. Two years later the community was found to be deeply in debt, and the joint-stock company was dissolved. As a purely religious organization it continued to exist for some years, but during the Civil War merged in the Hopedale parish, with Mr. Ballou as pastor, the industries founded by the society being carried on by private management. Consult Adin Ballou, *History of the Hopedale Community* (Lowell, 1897).

HOPE DIAMOND. A large blue diamond, in the possession of the family of H. T. Hope, weighing 44¼ carats. It is supposed to have been cut from a stone purchased from Tavernier by Louis XIV., which weighed uncut 112½ carats, and 67½ carats after cutting. The stone was lost in 1792, and the Hope diamond came into the market in 1830.

HOPEFUL. In Bunyan's *Pilgrim's Progress*, the companion of Christian on the journey from the City of Destruction to the Delectable Mountains and the Shining Gate.

HOPE THEATRE, THE. A sixteenth-century bear-garden, on the Bankside, Southwark, London, which was changed into a playhouse in

1581. It was restored to its former use at the Restoration, but toward the end of the seventeenth century gradually lost its popularity.

HOPFEN, hȯp′fen, Hans von (1835-1904). A German novelist and poet, born and educated at Munich. In 1866 he moved to Berlin, where he devoted himself to literature, having already edited the *Münchener Dichterbuch* (1862) and written the novel *Peregretta* (1864). A book of essays, *Streitfragen und Erinnerungen* (1876); a volume entitled *Theater* (1889); the plays *Aschenbrödel in Böhmen, In der Mark;* the *Neues Theater* (1892-93); the tragedy *Göttin der Vernunft* (1892); the drama *Helga* (1892); and the comedy *Es hat so sollen sein* (1893), comprise his best dramatic and miscellaneous work. The remainder of his writings include a score of novels and collections of stories, of which the following may be mentioned: *Verdorben zu Paris* (2d ed. 1892); *Die Heirat des Herrn von Waldenberg* (2d ed. 1884); *Der alte Praktikant* (3d ed. 1891); *Die Geschichten des Majors* (3d ed. 1882); *Neue Geschichten des Majors* (1890); *Im Schlaf geschenkt* (4th ed. 1896); *Zehn oder elf* (1901); and *Gotthard Lingens Fahrt nach dem Glück* (1902).

HOP-HORNBEAM. See Hornbeam.

HOPI, hō′pê, or **MOKI**, mō′kê. An interesting Pueblo tribe of Shoshonean stock, occupying seven villages upon three mesas in north central Arizona, and numbering about 1600, including those of Tewa or Hano. The principal villages are Walpi and Oraibi. In many respects the Hopi may be considered the most interesting of Pueblo tribes. They are all mesa-dwellers, their villages being situated hundreds of feet above the surrounding desert. They are only to be reached by steep, adventurous trails. They hold fast to their old aboriginal culture, which is of the typical Pueblo character, but better preserved than that along the Rio Grande. Their ceremonials are elaborately conducted, particularly those of the 'new fire' and the 'winter solstice,' also the celebrated snake dance, in which the performers carry living rattlesnakes in their mouths as they dance. They are industrious farmers and have always in their granaries abundant stores of corn, beans, and pumpkins. They also weave baskets and blankets, and are skillful potters and wood-carvers. (See Colored Plates in articles Basket and Blanket.) The clan system is rigid and highly developed among them. According to archæological evidence, the ancestors of these tribes were authors of many of the ancient ruins in the surrounding region. The people of the small village of Hano are of different language, originally being refugees of Tanoan stock, who fled from the Rio Grande at the time of the great Pueblo rebellion in 1680.

HOP-INSECTS. The most destructive insect enemy of the hop crop is the hop-aphis. Other species are of less importance, but they sometimes do considerable damage to the plant. The hop-grub or hop-plant borer (*Gortyna immanis*) is the larva of a noctuid moth which lays its eggs in the early part of the season upon the young shoots of the plant. The young caterpillars, which are slender and greenish in color spotted with black, bore into the vine just below the tip and remain at this point for some time. The head turns downward and stops growing. Such vines are called 'muffled heads' or 'stag vines,' and sometimes 'bullheads,' the caterpillar at this time being called 'tip-worm.' A little later it drops to the ground and enters the stem at the surface of the ground. It is then called the 'collar-worm,' changing to a white color with black spots. About the end of July it becomes full-grown and transforms to pupa near the roots of the plant. The moth issues in the fall or in the spring.

A number of different caterpillars feed upon the foliage. The hop-vine snout-moth (*Hypena humuli*) is one of the principal forms. The larvæ of two butterflies (*Polygonia interrogationis* and *Polygonia comma*) feed quite abundantly upon this plant and are known to hop-growers as 'hop-merchants' from the gold and silver markings upon the chrysalids. The zebra caterpillar (larva of *Mamestra picta*), the common woolly-bear caterpillar (larva of *Spilosoma virginica*), and the saddle-back caterpillar (larva of *Empretia stimulea*) are the remaining principal species. One of the leaf-hoppers, *Tettigonia confluenta,* causes more or less damage to the foliage, and the striped flea-beetle (*Phyllotreta vittata*) also damages the leaves, while the so-called 'red spider' or 'spinning mite' (*Tetranychus telarius*) often causes the leaves to turn yellow. The best remedy for all of these insects consists in spraying at the proper time, using an arsenical spray for the caterpillars and the flea-beetle, a kerosene emulsion for the leaf-hoppers, and a sulphur wash for the spinning mite. Consult Howard, "Pests of the Hop Crop," in *The Hop Industry* (New York, 1898).

HOPKINS, Edward (1600-57). A Colonial Governor of Connecticut. He was a London trader who came to Boston in 1637, and settled at Hartford. He was chosen Governor of the Colony of Connecticut several times during the period 1640-1654. After that he lived in London. He assisted in forming the Union of the New England Colonies in 1643. He left £1000 to support grammar schools in Hartford and New Haven. With the sum of £500 left for 'public ends,' Harvard College, to which it was turned over, bought a township from the 'praying Indians,' and named it Hopkinton.

HOPKINS, Edward Jerome (1836-98). An American musician, born at Burlington, Vt. He was practically a self-taught musician, and remarkably precocious. He held many positions as organist in New York City, was the originator of the 'lecture-concerts,' and made many concert tours in the United States, and in 1890 in England. He founded the American Music Association (1856) for performing native works: the Orpheon Free Schools (1865), which had over 30,000 pupils; and the New York *Philharmonic Journal* (1868). His compositions embrace almost every department of music, but although many of them, as *Easter Festival Vespers* (for three choirs, echo choir, two organs and orchestra, harp and cantor priest), are of strikingly original form, they have not met with much favor. He died at Athenia, N. J.

HOPKINS, Edward Washburn (1857—). An American Sanskrit scholar and philologist, born at Northampton, Mass. He graduated at Columbia College, New York, in 1878, and after studying in Germany and teaching at Bryn Mawr College, Pa., he was called to Yale University in 1895, as professor of comparative philology and Sanskrit, to fill the chair left vacant by the death of Whitney. Besides numerous contributions to the Oriental and philological journals of America, he is the author of several important books connected with India: *The Four Castes in Manu* (1884); *Religions of India* (1895); *The Great Epic of India* (1901); *India Old and New* (1901).

HOPKINS, Esek (1718-1802). An American naval officer, born in Scituate, R. I. In the Revolutionary War he was at first a brigadier-general in the army, but in 1775 Congress commissioned him commander-in-chief of the new American Navy. Washington officially addressed him as admiral. He went to sea in February, 1776, with four ships and three sloops, and took the forts at New Providence, with all the guns, ammunition, and stores. On his return he seized a British schooner and a bomb-brig. His later operations were less fortunate, and in January, 1777, he was dismissed from the service because he let the *Glasgow* get away from him and failed to appear before Congress when so ordered. He was afterwards prominent in Rhode Island political affairs. Consult Field, *Esek Hopkins, Commander-in-Chief of the Continental Navy During the American Revolution, 1775-78* (Providence, 1898).

HOPKINS, Ezekiel (1634-90). Bishop of Londonderry. He was born at Pinne, Devonshire, December 3, 1634. His early education was conducted under Presbyterian and independent influences. He graduated B.A. at Oxford (1653), and became chaplain of Magdalen College (1656). In 1662 he conformed, and was presented to the living of Saint Mary Woolnoth, in London. When the great plague broke out in the capital (1666), Hopkins withdrew to Exeter, where he obtained the living of Saint Mary's. When Lord Robartes was made Lord Lieutenant of Ireland (1669), Hopkins went with him to Dublin, and through his influence obtained the deanery of Raphoe (1670), and in 1671 the bishopric of Raphoe. In 1681 he was made Bishop of Londonderry. In the course of the siege of the town by the Irish adherents of James II., in 1689, Hopkins withdrew from the town, and retired first to Raphoe and afterwards to London, where he was made rector of Saint Mary Aldermanbury (1689). This charge he held until his death, June 19, 1690. His works, which have been frequently republished, comprise: *Sermons; Expositions of the Decalogue and the Lord's Prayer;* and elaborate discourses on *Regeneration* and *The Vanity of the World.* The best edition of his collected works is by Pratt (London, 1809).

HOPKINS, John Henry (1792-1868). A Protestant Episcopal bishop. He was born in Dublin, Ireland, January 30, 1792; came to the United States in 1801, and became an iron-manufacturer in Pennsylvania. Not succeeding in business, he studied law, and began practice in Pittsburg, but in 1823 he entered the ministry of the Protestant Episcopal Church. In 1831 he accepted the charge of Trinity Church, Boston, and the next year was chosen Bishop of Vermont, taking also the rectorship of a church in Burlington. He took great interest in education, and made heavy pecuniary sacrifices for its promotion. After 1856 he devoted his whole time to the supervision of the diocese. Hopkins was a prolific writer, leaving nearly twenty published works, among which are: *Christianity Vindicated* (1833); *The Primitive Creed Examined and Explained* (1834); *The Novelties which Disturb Our Peace* (1844); *History of the Confessional* (1850); *The American Citizen, His Rights and Duties* (1857); *A Scriptural, Ecclesiastical, and Historical View of Slavery* (1864). He was prominent in the Lambeth Conference in London in 1867. He died at Rock Point, Vt., January 9, 1868. Consult his biography (New York, 1873), by his son John Henry (1820-91).

HOPKINS, Johns (1795-1873). An American financier and philanthropist. He was born of Quaker parentage in Anne Arundel County, Md., where he lived on a farm until he was seventeen, when he went to Baltimore, and worked for a time in his uncle's grocery. Afterwards he became a merchant, with wide connections in Maryland, Virginia, and North Carolina. His credit and counsel were highly valued in financial and mercantile affairs, and he became one of the leading financial men in Baltimore. His services to the Baltimore and Ohio Railroad were of great value. Toward the end of his life, having no children, he determined to devote his fortune to the service of the public. Accordingly, in addition to minor gifts to individuals and charities, he founded and endowed two great institutions which perpetuate his name—the Johns Hopkins University and Johns Hopkins Hospital, whose activities are united in the Johns Hopkins Medical School. The total gift for these two purposes was more than $7,000,000.

HOPKINS, Lemuel (1750-1801). An American political poet, born in Connecticut. He practiced medicine at Litchfield, and after 1784 in Hartford, where he became allied with the 'Hartford Wits,' Joel Barlow, John Trumbull, David Humphreys, Theodore Dwight, and others, and with them wrote: *The Political Greenhouse, The Echo,* and—advocating strong federal government—*The Anarchiad* (republished at Hartford, 1861). Hopkins also wrote *The Hypocrite's Hope* and *The Victim of a Cancer Quack.*

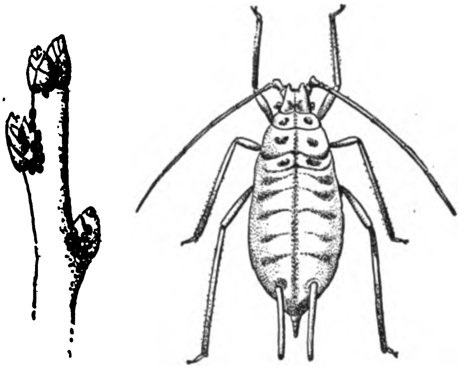
HOPKINS, Mark (1802-87). An American educator, grandnephew of the theologian Samuel Hopkins, and brother of the astronomer Albert Hopkins. He was born at Stockbridge, Mass., was educated at Williams College, was tutor there for two years, and, after studying medicine and practicing for a short time in New York, became professor of moral philosophy in Williams in 1830, and president of the institution in 1836. He resigned this position in 1872, but remained college preacher and incumbent of the chair of moral philosophy. In 1857 he had become president of the American Board of Foreign Missions. Undoubtedly one of the greatest of American educators of his day, Hopkins did much to build up the prestige of Williams College and much more to develop the individual student. He was a powerful preacher and a successful lecturer. He published: *The Influence of the Gospel in Liberalising the Mind* (1831); *The Connexion Between Taste and Morals* (1841); his Lowell Lectures, *The Evidences of Christianity* (3d ed. 1875); *Miscellaneous Essays and Reviews* (1847); a second series of Lowell Lectures, *Moral Science* (1862); *The Law of Love and Love as a Law* (last ed. 1881); *An Outline Study of Man* (last ed. 1893); *Strength and Beauty* (1874; in 1884 under the title *Teachings and Counsels*); and *The Scriptural Idea of Man* (1883).

HOPKINS, Samuel (1721-1803). An American clergyman and founder of the Hopkinsian theology. He was born at Waterbury, Conn., September 17, 1721. Having graduated at Yale College in 1741, he studied theology with Jonathan Edwards, and from 1743 to 1769 was pastor of Housatonic, now called Great Barrington, Mass. He then removed to Newport, where he died December 20, 1803. His writings consist of a life of Jonathan Edwards, sermons, addresses, a work on the millennium, and a system of theology, republished in Boston, 1852. He was remarkable for his simplicity, earnestness, and persevering industry. His peculiar theological doctrines have found numerous followers in America in certain of the Christian bodies of which the tenets are generally Calvinistic. They hold most of the Calvinistic doctrines, even in their most extreme form; but they entirely reject the doctrine of imputation, both the imputation of Adam's sin and of Christ's righteousness. The fundamental doctrine of the Hopkinsian system, however, is that all virtue and true holiness consists in disinterested benevolence, and that all sin is selfishness—the self-love which leads a man to give his first regard even to his own eternal interests being condemned as sinful. Consult his collected writings with memoir by E. A. Park (Boston, 1852).

HOPKINS, Stephen (1707-85). A Colonial Governor of Rhode Island, and one of the signers of the Declaration of Independence. He was born in Providence, R. I., and was descended from an old English family, his great-grandfather, Thomas Hopkins, having settled in Providence about 1638. Stephen's early life was spent on a farm, and he had little opportunity to gain an education, though under the tutelage of his grandfather and uncle he learned surveying, and later broadened his intellectual horizon by extensive reading. In 1732 he began his active participation in public affairs by becoming clerk of the newly constituted township of Scituate, a position which he continued to hold for ten years. From 1732 to 1738 (excepting the year 1734) he was a representative from Scituate to the General Assembly, and upon being returned in 1741 he was chosen Speaker. He became a justice of the Court of Common Pleas in 1736 and was appointed its clerk in 1741. Six years later he was made assistant justice of the Superior Court at Newport and in 1751 Chief Justice. He was one of the Rhode Island delegates to the intercolonial congresses which met in 1746, 1754, 1755, and 1757, and in the Albany convention of 1754 was a member of the committee which was appointed to draw up a 'plan of union.' (See Albany Convention.) In 1755 he was elected Governor of Rhode Island and was reëlected almost continuously until 1768, when he withdrew finally from the gubernatorial contest. Meanwhile he had acquired large shipping and commercial interests, and had begun to take an active interest in the question of England's right to tax the Colonies. In 1764 he sent to the Assembly a tract, *The Rights of Colonies Examined*, which the Assembly ordered to be published and which was widely read. After acting as chairman of several Colonial committees, he was a member of the General Assembly from 1770 to 1775. In 1774 he framed a bill to prohibit the importation of slaves, and from 1774 to 1780 was one of Rhode Island's representatives in the Continental Congress, being one of the signers of the Declaration of Independence in 1776. He was also a member of the Rhode Island Council of War and a delegate to numerous New England conventions. He died in Newport. He wrote: *A True Representation of the Plan Formed at Albany for Uniting All the British North American Colonies* (1755); and *An Historical Account of the Planting and Growth of Providence* (originally published in the Providence *Gazette* in 1762 and 1765), which, though a fragment, is of considerable value. It has been republished in the *Collections of the Massachusetts Historical Society*, 2d series, vol. ix. (Boston, 1822), and in the *Collections of the Rhode Island Historical Society*, vol. vii. (Providence, 1885). Consult Foster, *Stephen Hopkins, a Rhode Island Statesman* (Providence, 1884; forming Nos. 19 and 20 of the Rhode Island Historical Tracts).

HOP'KINSON, Francis (1737-91). An American politician, jurist, and miscellaneous writer, born in Philadelphia, Pa. He is best remembered for his *Battle of the Kegs* (1778), a humorous ballad based on an incident in the Revolutionary War. He was educated at the College of Philadelphia, admitted to the bar in 1761, and a few years later he spent a year in England, where his cousin was then Bishop of Worcester. Returning to Philadelphia, he practiced law, was active in learned societies, declared his republican sympathies, and, having removed to New Jersey, was made delegate to the Continental Congress (1776). He took part in drafting the Articles of Confederation, and signed the Declaration of Independence. He held various offices under the Federal Government, was Judge of Admiralty for Pennsylvania (1779-89), suffered an impeachment which failed, and was district judge there (1790-91). Hopkinson was a man of exceptionally varied accomplishments. He composed music for his facile songs, painted, was a dilettante in popular science, a humorist, and a political pamphleteer. His works were collected in three volumes (Philadelphia, 1792). Besides the *Battle of the Kegs*, his most popular production was a short prose allegory of the relations between the Colonies and the mother country, entitled *A Pretty Story* (1774). He was father of Joseph Hopkinson (q.v.).

HOPKINSON, John (1849-98). An English physicist and electrical engineer. He was born at Manchester, England, and received his education at Owens College, Manchester, and at Trinity College, Cambridge, where he graduated with honors in 1871 and was appointed fellow and tutor. Commencing practice as an engineer, he soon became interested in electrical engineering, and was led to many important investigations. He was made a fellow of the Royal Society of London in 1878, and in 1890 was awarded by it a royal medal for researches in electricity and magnetism. He was at the time of his death a member of the Councils of the Institutions of Civil and Mechanical Engineers and professor of electrical engineering in King's College, London. Among his most important researches are those in which he showed the effect of temperature upon the magnetic properties of various metals. He was an authority in the theory and practice of dynamo-electric machinery, and discovered the method of employing the so-called 'characteristic curve' in discussing such problems. This curve is obtained by taking the electro-motive forces as ordinates and the current as abscissas, and serves for the dynamo the same purpose as the indicative diagram in the case of the steam-engine. He was the author of: *Dynamic Electricity* (1884); *Original Papers in Dynamo Machinery and Allied Subjects* (1893); and many papers on various electrical and engineering subjects. He met his death with his children in an accident while mountain-climbing in the Alps.


HOP-LOUSE.

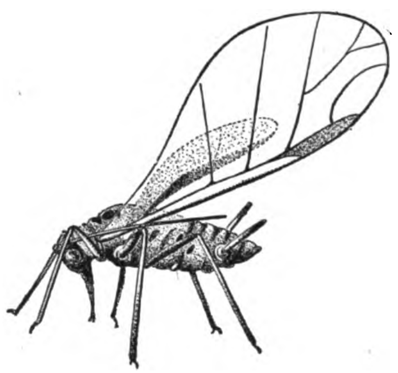
TWIG WITH WINTER EGGS; NATURAL SIZE. PARTHENOGENETIC FEMALE; SECOND GENERATION.

HOPKINSON, Joseph (1770-1842). An American jurist, born in Philadelphia, Pa. He graduated at the University of Pennsylvania in 1786, and in 1791 began the practice of law at Easton, Pa., but soon removed to Philadelphia, where he rose to the front rank in his profession. He was the leading counsel in the famous suit of Rush *vs.* Cobbett in 1799, and defended Judge Chase in his impeachment before the Senate in 1800. From 1815 to 1819 he served as a Federalist Representative in Congress, where he distinguished himself in the debates on the tariff and the Seminole War, and strongly opposed the rechartering of the United States Bank. In 1828 he was appointed by President Adams a district judge, an office which he held until his death. For several years he was president of the Philadelphia Academy of Fine Arts and Vice-President of the American Philosophical Society, to each of which he contributed many papers of interest. In 1837 he was a member of the Pennsylvania Constitutional Convention, and served as chairman of his Judiciary Committee. His legal essays and decisions were long accepted as authoritative; but he will be longest remembered for his national song, "Hail Columbia," written in 1798, which attained immediate popularity and did much to fortify wavering patriotism.

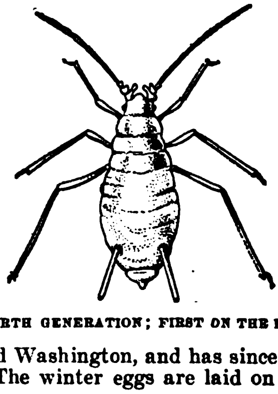
HOP'KINSVILLE. A city and the county-seat of Christian County, Ky., 75 miles northwest of Nashville, Tenn.; on the Louisville and Nashville and the Illinois Central railroads (Map: Kentucky, D 4). It is the seat of the South Kentucky College (Christian), established in 1849, Bethel Female College (Baptist), founded in 1854, and of the Western Kentucky Lunatic Asylum. The city is principally engaged in tobacco manufacture and trade, but has a considerable business also in flour, wheat, corn, hay, and live stock. Hopkinsville was settled in 1797 and incorporated in 1798. As provided by a charter of 1893, revised in 1896, the government is administered by a mayor, elected every four years, and a municipal council of which the executive is a member. Population, in 1890, 5833; in 1900, 7280.

HOP'LOPHO'NEUS (Neo-Lat., from Gk. ὅπλα, *hopla*, arms + φόνιος, *phonios*, murderous). A Miocene fossil cat, found in the White River formation of Colorado, Wyoming, and the Dakotas. See Sabre-Toothed Tiger.

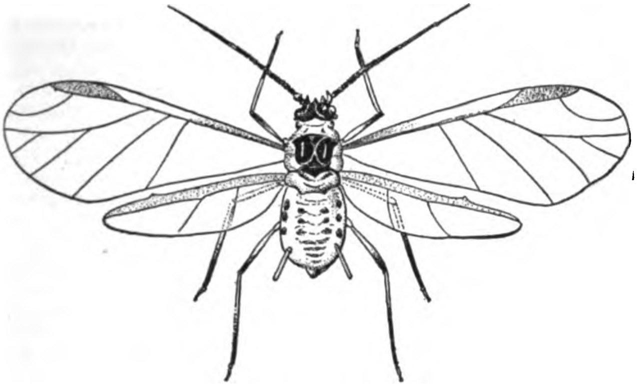
HOP-LOUSE. A very destructive aphid or plant-louse (*Phorodon humuli*), found commonly on the hop-plant, and called in England 'hop-fly.' In certain years this insect causes an almost total loss of the hop crop in parts of England and New York, and a number of years ago forced the abandonment of this industry in Wisconsin. About 1890 it made its first appearance in the States of Oregon and Washington, and has since done great damage. The winter eggs are laid on plum-trees

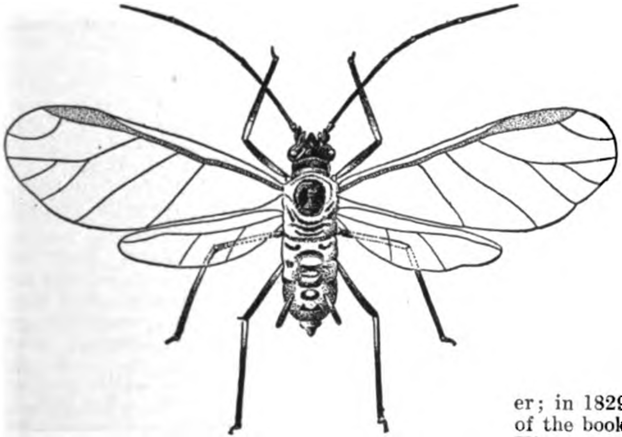

WINGED MIGRANT, THIRD GENERATION.

HOP-LEAF, WITH LICE; NATURAL SIZE.


FOURTH GENERATION; FIRST ON THE HOP.

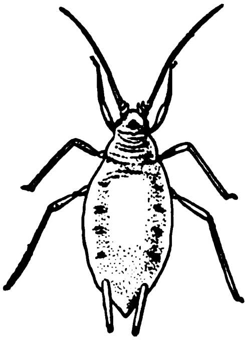
in the neighborhood of the hop-yards. These eggs hatch in the spring at the time when the buds are about to burst, and three generations of wingless, parthenogenetic females are born upon the plum-trees. Then a fourth generation, consisting of winged agamic females, makes its appearance. These females fly to the hop fields and establish themselves there, giving birth to living young which, agamic and wingless, give birth to individuals like themselves. The tenth or eleventh generation is winged, flies back to the plum, and gives birth to true sexual females which are wingless, but which mate with winged males which fly in from the fields. The winter egg is then laid once more upon the plum twigs. (See ALTERNATION OF GENERATIONS, and APHID.) The best remedy for this injurious creature is to cut down all but one or two of the plum-trees near the hop-yard, and then to destroy in May all of the lice on the one or two remaining trees by spraying with a dilute kerosene-soap emulsion or a fish-oil soap wash.

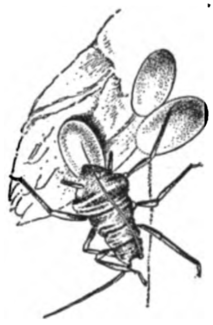

WINGED RETURN MIGRANT, OR PUPIFER.


WINGED MALE, AT END OF SUMMER.

HOP O' MY THUMB. The diminutive hero of a popular fairy tale, taken from Perrault's *Comtes des Fées*, the popular sources of which are the classic stories of Ulysees and Polyphemus and of Theseus and Ariadne.

HOP′PER, ISAAC TATEM (1771-1852). An American philanthropist, prominent in the antislavery movement. He was born in Deptford township, Gloucester County, New Jersey, December 3, 1771. At sixteen years of age he was apprenticed to an uncle in Philadelphia to learn the trade of a tailor. In early manhood he became an active and leading member of the abolition society founded by Franklin, Rush, and others, and was also an overseer of a school for colored children, secretary of a society for the employment of the poor, inspector of a prison, guardian of abused apprentices, and a friend of the insane. He belonged to the Society of Friends, and in the division which occurred in 1827-28 he acted with those who were called 'Hicksites,' influenced much, no doubt, by his great regard and admiration for Elias Hicks as an earnest antislavery preacher; in 1829 he came to New York to take charge of the book-store opened by the Hicksite Friends. His activity in opposition to slavery exposed him to much abuse and even imperiled his life; but this did not in the least abate his zeal. In 1841 he gave up the charge of the book-store and was appointed treasurer and office agent of the American Anti-Slavery Society, and so continued until 1845, when he became the first agent of the New York Prison Association. Declining years and ill health compelled his resignation in February, 1852. He died in New York, May 7, 1852. Consult his life by Child (New York, 1881).


NORMAL PARTHENOGENETIC FEMALE; SIXTH GENERATION.


SHRUNKEN FEMALE IN ACT OF DEPOSITING WINTER EGGS.

HOPPE-SEYLER, hôp′pe-zī′lẽr, FELIX (1825-95). A German physiologist and chemist, born at Freyburg-on-the-Unstrut, and educated at Halle, Leipzig, Berlin, Prague, and Vienna. After five years as assistant to Virchow and director of the chemical laboratory of the Berlin Pathological Institute, he became professor of applied chemistry at Tübingen (1861), and (1872) of physiological chemistry at Strassburg. He wrote: *Handbuch der physiologisch- und pathologisch-chemischen Analyse* (6th ed. 1893); *Medizinisch-chemische Untersuchungen* (1866-70); and *Physiologische Chemie* (1877-81). Consult Baumann and Kossel, *Zur*

Erinnerung an Felix Hoppe-Seyler (Strassburg, 1895).

HOP'PIN, AUGUSTUS (1828-96). An American book illustrator, born in Providence, R. I. He graduated at Brown University in 1848, and was admitted to the bar, but soon gave up the law and went abroad to study art. Upon his return, he devoted himself to drawing on wood and to the illustration of books, in which he was successful. His pictures in *Nothing to Wear, Potiphar Papers*, and *The Autocrat of the Breakfast Table* are widely known. He published several volumes of sketches and novels, among the latter *Recollections of Auton House* (1881), and *Married for Fun* (1885).

HOPPIN, JAMES MASON (1820—). An American educator and writer. He was born at Providence, R. I., graduated at Yale in 1840, at the Harvard Law School in 1842, and at the Andover Theological Seminary in 1845; studied for some time abroad and was pastor of a Congregational church at Salem, Mass., from 1850 to 1859. From 1861 to 1879 he was professor of homiletics at Yale, where he was also professor of the history of art from 1879 to 1899, when he became professor emeritus. Among his publications are: *Old England, Its Art, Scenery, and People* (1867); *The Office and Work of the Christian Ministry* (1869); *Life of Rear-Admiral Andrew Hull Foote* (1874); *The Early Renaissance and Other Essays on Art Subjects* (1892); and *Greek Art on Greek Soil* (1897).

HOPP'NER, JOHN (1758-1810). An English painter, of German parentage, born in London. He was a choir-boy in the Royal Chapel, and afterwards, by the assistance of the Prince of Wales (afterwards George III.), studied at the Royal Academy. He became a popular portrait painter, and was acknowledged by Lawrence to be his only rival. His works include portraits of the Prince, the Duke of York, Lord Nelson, Pitt, Wellington, Canning, and Grenville. He wrote a book entitled *Select Series of Portraits of Ladies of Rank and Fashion* (1803), the illustrations of which were from paintings by himself, engraved by Wilkins. One of his best works is "Lady Culling Smith and Her Children." He is more successful in his portraits of women and children than of men, as his art has an altogether feminine quality and lacks the robustness of Reynolds, whom he sometimes imitated.

HOP-TREE (*Ptelea trifoliata*). An American shrub of the rue family, called also shrubby trefoil, wafer-ash, and wingspeed, which grows in rocky places from Pennsylvania to Minnesota and southward. It usually grows from 6 to 10 feet in height, but when well trimmed and cultivated sometimes attains a height of 30 feet or more. The leaves are trifoliate, the leaflets obovate and pointed, and downy when young; the flowers, which grow in terminal cymes, are greenish white, and have a disagreeable odor. The fruit has a broad wing which resembles that of the elm, and is very bitter, but does not possess the aromatic principle of the hop; nevertheless, it is said to have been used as a substitute for hops in making beer. The bark and root are of some repute in medicine. When dried the bark has a peculiar, somewhat aromatic smell, and a bitter, pungent, acrid taste. The bark contains an acrid, bitter oleo-resin, starch, albumin, a yellow coloring substance, and salts of lime, potash, and iron; also the alkaloid berberine, probably the tonic principle.

HOR, hōr (Heb., mountain). (1) A mountain of Arabia Petræa, between the Gulf of Akabah and the Red Sea, and forming part of the mountain range of Edom or Seir. It was here that Aaron (q.v.) is said to have died during the journey of the Israelites into Palestine (Num. xx. 22-29; xxxiii. 38, 39; Deut. xxxii. 50). The modern name of the place is Jebel Haroun ('Mount of Aaron'), and the Mohammedans point to a structure on the top of the mountain as the tomb of the brother of Moses. (2) A mountain which was to be the northern border of the inheritance of the Hebrew tribes (Num. xxxiv. 7). If the Hebrew text is correct (which is doubtful), the name refers to the Lebanon range, and probably to Mount Hermon. Some scholars, however, give the preference to Jebel Akkar, in the northeast of the Lebanon.

HORA, hō'rȧ, JUON (c.1740-85). A Ruman patriot and national hero of Transylvania, sometimes called *Nikla Urss*, Nicholas the Bear. With Juon Kloska and George Kriszán, he roused the people to rebellion against the Imperial order for general conscription (1784). The uprising spread until thirty thousand men had joined. But Imperial troops were hurried in in such numbers that the revolt failed, the three leaders were captured, and Hora was killed. Hora's exploits form the theme of popular Ruman songs.

HORACE, ō'räs'. A five-act tragedy in verse, by Pierre Corneille, produced in 1640. It is founded on the old Roman legend of the Horatii and Curiatii. In it patriotism and affection are contrasted in the characters of Horace and Curiace, the latter being the lover of the former's sister. One of Lope de Vega's plays, *El honrado hermano*, is founded on the same myth.

HORACE (QUINTUS HORATIUS FLACCUS) (B.C. 65-8). A Latin poet, born at Venusia, on the borders of Lucania and Apulia. His early years were thus passed amid a picturesque environment of mountain, forest, and stream, which made a deep impression upon his mind, and strengthened that love of nature which so often finds expression in his verse. The older Flaccus was a *coactor*, a collector of taxes or of money due for goods sold at public auctions, and by his thrift was successful not only in buying his own freedom, but also in acquiring a small estate and an income which enabled him to give to his son the best education the capital itself could offer. Thither, about the age of twelve, Horace went with his father, who, in his affection and devotion to his son's interests, made himself the boy's comrade in the daily round of study and play, and at Rome, as at Venusia, helped to form his son's standards by his own shrewd comments upon men and manners. It was naturally the *mos maiorum* rather than any abstract ideal of which the freedman pointed out the advantages, but the familiar talks had their desired effect in the rise in Horace's mind of an instinctive aversion to excess of every sort, and trained him, besides, in similar habits of keen observation and pointed, though kindly, criticism. It was then customary among young Romans of birth and means to complete their education by what may be called a university course in the schools of philosophy at Athens or in those of oratory at Rhodes, and so, between eighteen and twenty, Horace took up his residence at Athens, listened to the exposition of conflicting philosophical theories, and entered into the social life of his fellow students. Purely speculative problems attracted him as little as they did the average Roman, nor had he, in fact, much relish for the technicalities of any philosophical system. The paradoxes and social eccentricities of the Stoic thinkers, for instance, long made it difficult for him to do justice to the real elevation of their essential principles. But he had already become profoundly interested in the practical problem of how to order one's life aright, and his stay at Athens confirmed this taste for ethical inquiry. At this time, too, he must have come to know more intimately the work of Alcæus, Sappho, Archilochus, and the other Greek lyric poets who were to be his models in the *Epodes* and the *Odes*.

But these peaceful and congenial pursuits were suddenly interrupted by the news of the assassination of Cæsar in March, 44, and the subsequent arrival of Brutus in Athens to secure recruits for the republican cause. The liberator, himself a lover of letters and an eager student of philosophy, was received with enthusiasm, and was so much taken with Horace's promise that the latter, despite his youth and lack both of family connection and of military experience, was made a staff officer, and ultimately served in the campaign of Philippi as *tribunus militum*. That decisive defeat and the suicide of his chief seem to have convinced him of the futility of further effort, and he made his way back to Rome, where, finding that his father's estate had been confiscated, he obtained employment as a clerk in the quæstor's office. It was the darkest period of his life, and, as the earliest of the *Epodes* show, the bitterness of his feeling found unrestrained expression in the verses which, in his own words, poverty drove him to write. But he was so fortunate as to win the regard of Vergil and Varius, who, three years after his return to Italy, introduced him to Mæcenas. That discerning but cautious statesman waited nine months after the first interview before he again sent for the young writer. He then bestowed the friendship that saved Horace for poetry.

But it was in metrical prose rather than imaginative poetry, as he himself viewed his work, that Horace first tried to gain an audience. Early training and the mood of the moment combined to make the choice of satire almost inevitable. Lucilius, a member of the Scipionic circle, had for the first time in Latin literature used the old *mélange* form of Ennius as a vehicle for witty and often stinging criticism of the political and social life of his time. The range of topics was naturally exceedingly wide, the treatment often dramatic, and cast in the dialogue form, the metres varied, though in the end the hexameter decidedly predominated. The new *satura* was marked by a feature quite as original and as noteworthy as itself. This was the establishment of a personal and intimate relation between Lucilius and his reader, so that the frankest revelation of the poet's inmost feelings seemed yet free from egotism and consistent with self-respect. It was thus natural that Horace should be strongly attracted by Lucilius, though, with a mind already much occupied with the niceties of phrase and cadence, he could not but feel that, despite all its vigor and charm, the work of the older poet was sadly lacking in artistic finish. To write in the manner of Lucilius, but with a more perfect art—this was the end proposed and achieved in the *Satires* (*Sermones, 'causeries,'* as he calls them), of which the first volume appeared about B.C. 35. The second, published about B.C. 29, is far superior in execution to the first, and shows Horace at his best in this kind. We are listening to an accomplished man of the world, intimately acquainted with human nature, whose whims and weaknesses he probes with delightful humor. He is exceedingly fond of the weapon of irony, which he uses against himself quite as often as against others, and every page reflects his sunny nature, genuinely tolerant and charitable. These 'talks,' however light in their touch, have yet a definite and serious purpose. It is the art of living that is ever under discussion, and, as he studied others, so also Horace studied most minutely the nature best known to him, so that one of the special charms of the *Satires* is the presence of this constant self-analysis. One may say of Horace what Mr. Sidney Colvin says of Stevenson in his introduction to the *Vailima Letters*, that he "belonged to the race of Montaigne and the literary egotists." The word seems out of place, since of egotism in the sense of vanity or selfishness he was of all men the most devoid; but he was nevertheless a watchful and ever interested observer of the motions of his own mind. He saw himself as he saw everything else (to borrow the words of Mr. Andrew Lang) with the lucidity of genius, and loved to put himself on terms of confidence with his readers.

One notices already in the *Satires* an attitude of mind that became characteristic and was later both to limit his range and to widen his appeal as a lyric poet. He takes counsel of his head rather than of his heart, and distrusts enthusiasm, especially about ideas, as if warmth of feeling, not held carefully in check by the reason, rendered impossible that equipoise through which alone one may hope to see things as they really are. This is true of even his friendships, where he is tenderness and loyalty itself. But this studied moderation of thought and utterance is the fruit of experience and self-discipline. His earliest attempts in lyric verse show all the ardent temper of youth, and are marked by an exuberance of phrase in striking contrast with the wonderful compression of his later work. In these *iambi*, as he called them, published about B.C. 30, Archilochus is his model, though not more than half of the seventeen poems that Horace deemed worthy of preservation show the personal animosity associated with the name of the Greek poet. With one exception, the seventeenth, they are written in couplets, the second verse of which forms a refrain (*epodus*, ἐπῳδός) to the first, and thus they came in time to be known as *Epodes*. Immature as they are as a whole, and interesting chiefly as the first essays of the Horace of the *Odes*, three certainly reveal poetical power of no mean order—the idyllic second, with its sudden turn to satire at the close, the fifth, with its extraordinary picture of the sorceress Canidia, and the passionate appeal to his countrymen in the sixteenth.

Shortly after the appearance of the first book of the *Satires*, Mæcenas presented Horace with a small farm among the Sabine hills, in the valley through which the cool Digentia flows south to join the Anio near the market-town of Varia, the modern Vico-Varo. Perhaps no gift ever exercised a more important influence upon a man's career. It was not merely that he was thus enabled to devote himself wholly to his art without thought of pecuniary return. The farm was his "*arx*," his sure retreat from the fatigues and distractions of the great world. The peace of nature, loved since the days at Venusia, entered into and possessed his soul, and the pure air—it was about two thousand feet above the sea—renewed his physical strength, of which, as the years passed, he had to take increasing care. He has immortalized the farm, and, indeed, the whole valley, in his affectionate praise. One may doubt whether he could have been happy without active participation in the brilliant life of the capital, but much of what is truest and best in the inspiration of the *Odes* and the *Epistles* is due to the many quiet days spent with his books *in Sabinis*.

The eighty-eight lyrics that are comprised in the first three books of the *Odes* were undoubtedly privately circulated among his friends previous to their final collection and publication in one little volume in the year 23. Their composition extended over about seven years, for the earliest that can be dated with certainty (i., 37) was written upon the receipt at Rome of the news of Cleopatra's suicide, and few, if any, could have preceded this. They were the outcome of long and loving study of the great Greek lyric poets, especially Alcæus and Sappho, belonging to the early classical period rather than to the Alexandrian age. But, while their form is similar, their content is vitally different in its effect, and it is difficult to define precisely the nature of that unfailing charm which almost from the moment of their appearance they have been universally felt to possess. Shelley in his *Defence of Poetry*, following a famous passage in Plato's *Phædrus*, and Sidney in his *Apologie for Poetry*, both maintained that "poets are so beloved of the gods that whatsoever they write proceeds of a divine fury." But nothing could be more alien to Horace's temper than this. He has neither the passion of Burns or Catullus in the expression or feeling, nor the absorbed and ecstatic earnestness of Lucretius in urging the claims of the true philosophy of life, nor yet the imaginative and mystical power of Vergil. Gray, however, a poet whose method of composition resembled Horace's in its critical deliberateness—in the second poem of the fourth book of *Odes*, Horace compares himself to a bee that with infinite labor gathers its sweets from many a flower—says in one of his letters: "Extreme conciseness of expression, yet pure, perspicuous, and musical, is one of the grand beauties of lyric poetry." The three adjectives here used are peculiarly appropriate to Horace's work; indeed, no other lyric poet in Latin literature has so exquisite a verbal technique. The *Odes* abound in phrases of such perfect finish that no change save for the worse seems possible, phrases which have been the common property of educated men for centuries: *Persicos odi, puer apparatus; carpe diem; dulce et decorum est pro patria mori; vixere fortes ante Agamemnona; matra pulchra filia pulchrior; nil desperandum; splendide mendax; dulce est desipere in loco; post equitem sedet atra cura*—to give a complete list would be almost to quote the *Odes* entire. Yet it is all a *curiosa felicitas*, as Petronius aptly described it, effects carefully and minutely wrought out by a mind trained in the nicest apprehension of the color values of words and an ear attuned to all the subtleties of cadence. And no artist was ever more alive to the delicate shades of meaning that words gain from their context. Partly, no doubt, from the difficulties inherent in the use of foreign metres, but more especially because of his own liking for moderation and simplicity, the vocabulary which he has chosen to employ is notably limited. Yet the oft-recurring words produce so different an effect in their ever-changing settings that one does not notice the repetition. The themes themselves are even more limited in their range than the vocabulary, but upon the few that he selects he plays variations of surpassing beauty. There is nothing transcendental, nothing of what Poe held to be the essence of poetry, "no mere appreciation of the beauty before us, but a wild effort to reach the beauty above." The *Odes* are rather the expression of idealized common sense, and just for this reason Horace has been in all ages the favorite poet of minds the most diverse, for none makes a surer appeal to the finer sensibilities of humanity in its every-day moods.

In the *envoi* to the first three books of the *Odes*, Horace expresses his entire confidence in their abiding fame, and with this achievement his lyrical impulse seems to have satisfied itself. A new series of 'talks' engaged his attention, cast, however, in a different literary form, that of the letter. These *Epistles*, of which the first book appeared toward the end of 20, or, at the latest, in 19, do not differ much from the *Satires* in the subjects discussed. Conduct is more than ever 'three-fourths of life.' But the years of reading and reflection have brought truer insight and greater breadth of view. He is still a searcher after the philosophy of life (his mind was far too independent to accept any creed formulated by others), but he urges with tactful insistence the elementary principles of whose truth he has become convinced. The humor is kindlier and more subtle; in fact, one is often in doubt whether he is speaking in jest or earnest, so that he has the inexhaustible charm of one whose secret is never wholly surprised. He is no idealist; it is rather the doctrine of the mean, the *aurea mediocritas*, that he so winningly inculcates. Not even virtue itself is to be sought beyond the bounds of reason, as indeed Aristotle had claimed long before him. Both the language and the metre of the *Epistles* show the effects of the seven years devoted to lyric composition. There is the same wealth of terse and happy phrase, and the hexameter, which even in the *Satires* was an immense advance upon the rhythm of Lucilius, is always smooth and often musical.

The death of Vergil in 19 left Horace by general consent the greatest living poet; and it was as such that in 17 Augustus commissioned him to write the hymn for the religious festival of the Secular Games. The result to modern ears may seem rather stiff and unimaginative in spite of the technical excellence of the verse, but to the great Roman audience—we must remember that the *Carmen Sæculare* was chanted in the open air—there must have been something peculiarly impressive in the linking of the old liturgical formulas with the new faith in the city's imperial destiny. Two years later, at the personal request of the Emperor, he composed two odes in celebration of the victories of Drusus and Tiberius, the step-sons of Augustus, over the Rhæti and Vindelici, and, about the same time, two others in praise of the beneficent results of the reign for Italy. But Horace, though he had long been a sincere supporter of the new régime, was ill fitted for work of this kind, and these poems, especially the first two, show the laboriousness that not infrequently attaches to the official odes of a poet laureate. To give them permanence, he added eleven fugitive pieces (one of which, however, the seventh, is a perfect gem), and published this fourth book of the *Odes* in 13.

According to Suetonius, the charming bit of literary criticism which opens the second book of the *Epistles* was written to meet a complaint of Augustus that to him alone Horace had dedicated nothing. It is in substance an attempt to show that no true parallel could be drawn between the development of poetry in Greece and that at Rome, and that the work of the modern school, of which he regarded Vergil, Varius, and himself as the best representatives, marked the highest level yet reached of artistic achievement. In the second of the two epistles of this book he sets forth at length with characteristic irony and indirection the reasons why henceforth lyric poetry must give place to the "rhythms and harmonies of real life." The latest of his letters and the one which is most nearly a formal essay is that addressed to the Pisos. It is generally known as the *Art of Poetry* (*Liber de Arte Poetica*), though this title seems not to have been given to it by Horace himself, and is, indeed, scarcely appropriate, for only one branch, that of the drama, receives any systematic treatment. The discussion has all the sanity and breadth of judgment that mark the moral epistles, and is, in effect, another defense of the poetic ideals of the Augustan school.

Of the details of the closing years of his life we have no record. The death of Mæcenas, who in his last words commended his life-long friend to Augustus, was a severe shock. Horace, who had once (C. ii., 17) prayed that they might not be separated in death, did not long survive him, dying on the 27th of November, B.C. 8, when he had nearly completed his fifty-seventh year. He was buried on the Esquiline, close to the tomb of Mæcenas.

Mr. Mackail has admirably summed up the significance of his work: "Among the many amazing achievements of the Greek genius in the field of human thought were a lyrical poetry of unexampled beauty, a refined critical faculty, and, later than the great thinkers and outside the strict schools, a temperate philosophy such as we see afterwards in the beautiful personality of Plutarch. In all these three Horace interpreted Greece to the world, while adding that peculiarly Roman urbanity—the spirit at once of the grown man as distinguished from children, of the man of the world, and of the gentleman—which up till now has been a dominant ideal over the thought and life of Europe."

BIBLIOGRAPHY. The *editio princeps* was published at Venice in 1470. The most important editions before Bentley were those of Lambinus (last edition, Coblenz, 1829), Cruquius (Antwerp, 1578), and Heinsius (Leyden, 1612). Richard Bentley's edition, first published at Cambridge in 1711 (3d ed., Berlin, 1869), made a new era in Horatian criticism. The best critical edition of the text is that of Keller and Holder (2 vols., Leipzig, 1864-70). Keller issued a second edition of the first volume (*Odes*, *Epodes*, and *Carmen Sæculare*) in 1899, and also a supplementary volume of text discussion, *Epilegomena zu Horaz* (Leipzig, 1879-80). The best general editions are those of Orelli revised by Hirschfelder and Mewes (4th ed., 2 vols., Berlin, 1886-92, with Latin notes and complete word index); Kiessling (2d ed., 3 vols., Berlin, 1890-97; vol. i. in 3d ed., 1898); Müller, *Odes and Epodes* (Leipzig, 1900), *Satires and Epistles* (1891-93); Wickham, *Odes and Epodes* (3d ed., Oxford, 1896), *Satires and Epistles* (1891); Schütz (Berlin, 1880-83; vol. i. containing *Odes and Epodes*, 3d ed., 1889). The *Odes* have been edited separately by Nauck (13th ed., Leipzig, 1889), Page (4th ed., London, 1890), Smith (Boston, 1895), Shorey (Boston, 1898); the *Satires* by Krüger (14th ed., Leipzig, 1897), Palmer (London, 1883); the *Epistles* by Wilkins (3d ed., London, 1889). Porphyrion's *Scholia* have been edited by Holder (Innsbruck, 1894).

The translations of Horace are all inferior to the original. Among the best are those of Francis, entire (London, 1778); Lord Ravensworth, *Odes* (London, 1858); Martin, entire (Edinburgh, 1888, with an interesting memoir and good illustrative notes); Conington, *Odes and Epodes* (3d ed., London, 1865), *Satires and Epistles* (1892); Lord Lytton, *Odes and Epodes* (London, 1869); Gladstone, *Odes* (New York, 1894); Cooper, *Odes* by various hands (London, 1880); Sargent, *Odes* (Boston, 1893); De Vere, *Selected Odes and Epodes* (London, 1893). A sumptuous edition of the *Odes and Epodes* is that of the Bibliophile Society (6 vols., Boston, 1901-02), with introduction, life, and Latin text, translated and annotated by 'eminent scholars, statesmen, and poets.' Pope's *Satires and Epistles of Horace Imitated* is very brilliant (best edition by Pattison).

The most valuable literary treatment of Horace is Sellar's *Horace and the Elegiac Poets* (Oxford, 1892). Good also are Boissier's *The Country of Horace and Vergil* (translated from the French, London, 1896), and Plüss, *Horazstudien* (Leipzig, 1882). There are good chapters on Horace in Nettleship, *Lectures and Essays*, first series (Oxford, 1885); Patin, *Etudes sur la poésie latine* (3d ed., Paris, 1883); Mackail, *Latin Literature* (New York, 1900); Tyrrell, *Latin Poetry* (Boston, 1895).

HO′RÆ (Lat., from Gk Ὧραι, *Hōrai*, hours, seasons; connected with ὧρος, *hōros*, year, Av. *yārə*, year, OChurch Slav. *jarŭ*, spring, OHG. *jār*, Ger. *Jahr*, Goth. *jēr*, AS. *ġēar*, Eng. *year*). In ancient Greece, goddesses of the seasons of the year, at first with special reference to the farmer. At Athens they seem to have been originally two, Thallo and Carpo, the goddesses of the blossoming and ripening fruit. In general they were at first three, Eunomia, Dike, Eirene, whose names show that the ethical side of their nature, as guardians of the due order and peaceful succession of natural processes, has become prominent. In the legend they are daughters of Zeus and Themis, guardians of the gates of Olympus, attendants upon the gods. They bring flowers and fruits to mortals, and are closely connected with the Charities (q.v.) or Graces. In the

Hellenistic time the Horæ become more closely connected with the seasons, and now the number is increased to four, each of whom is given attributes appropriate to a special season. These four Horæ, however, rarely appear in literature, until the late epic of Quintus Smyrnæus and Nonnus. The fiction of twelve Horæ for the hours of the day is also very late, and cannot be found in art with any certainty. Consult: Preller-Robert, *Griechische Mythologie*, vol. i. (Berlin, 1894), and Rapp, in Roscher, *Lexikon der griechischen und römischen Mythologie* (Leipzig, 1886 et seq.).

HOR'APOL'LO (Lat., from Gk. 'Ωραπόλλων, *Horapollōn*). An Egyptian who wrote on Greek grammar, probably in the fourth century A.D. He lived in Alexandria and at Constantinople, and wrote commentaries on the Greek poets. Another Horapollo lived at the close of the next century. It is uncertain whether we should ascribe to the former or to the latter the work on hieroglyphics, apparently a Greek translation of the work in Egyptian of one Horapollo, or possibly Horus, which gives this name importance, and which has some value to the Egyptologist. The best edition of the work on hieroglyphics is by Leemans (Amsterdam, 1835).

HORATII, hô-rā'shĭ-ī. Three Roman brothers, born at one birth, cousins to the Curiatii, of Alba, also three brothers born at one time. Their mothers were twins, who had been married on the same day, and given birth to their sons at the same time. During the Roman wars, when Cluilius, the Alban King, and Tullus Hostilius, the Roman King, were in conflict, it was decided to leave the issue to a personal combat between these brothers. Two of the Horatii were soon slain, and the third brother, feigning flight, was pursued by the Curiatii, all wounded, whom he slew one by one. The sister of the Horatii was betrothed to one of the Curiatii, and had made for him a beautiful mantle. As the victor entered the gate of Rome bearing his spoils, he was met by his sister, who, upon recognizing the cloak in her brother's hands, broke out in lamentations. Enraged that she should prefer her lover to her country, her brother slew her on the spot, and her body remained unburied until passers-by covered it with stones. He was condemned to be scourged to death, but was afterwards pardoned. The story is given by Livy (I. 24); behind the pure myth lies the fact of the close union in early times between Rome and Alba Longa, and the later subjection of the latter.

The famous Horatius (Cocles) who, with Titus Herminius and Spurius Lartius in B.C. 507, so gallantly defended the bridge against the army of Lars Porsena, King of Clusium, while their companions broke down the Sublician bridge behind them, was a worthy descendant of the survivor of the three Horatii.

HORATIO, hô-rā'shĭ-ō. (1) In Shakespeare's *Hamlet*, a character who in his philosophical attitude toward varying fortunes forms an admirable foil to his morbid and introspective friend Hamlet. (2) The friend of Lord Altamont in Rowe's *Fair Penitent*. He informs Altamont of Calista's seduction by Lothario, and the latter is killed in the duel which ensues.

HÖRDE, hēr'de. A town of the Prussian Province of Westphalia, situated on the Emsche, two miles by rail from Dortmund (Map: Prussia, B 3). In the vicinity are productive iron and coal mines, and the town has important industries connected with the working of iron. Population, in 1890, 16,346; in 1900, 25,126.

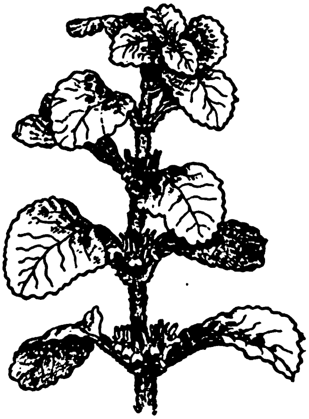
HORDEIN, hôr'dē-ĭn (from Lat. *hordeum*, barley). A substance that can be extracted from barley. It is merely a mixture of starch, cellulose, and a little nitrogenous matter.

HORDE'OLUM. See STYE.

HOR'DEUM. See BARLEY.

HOREB, hō'rĕb. See SINAI.

HORE'HOUND (AS. *hārhūne*, from *hār*, hoar + *hūne*, hoarhound), *Marrubium*. A genus of plants of the natural order Labiatæ. The species are mostly herbaceous perennials, natives of the south of Europe and the East. One species, the common or white horehound (*Marrubium vulgare*), is found generally throughout Europe, except in the more northern regions, and in the United States, growing in waste places, waysides, etc. It is about 1 to 1½ feet high, bushy, with roundish, ovate, crenate, wrinkled leaves, and almost globose whorls of white flowers. The whole plant has a whitish appearance, from the down with which its leaves are covered. It has an aromatic but not very agreeable smell. It is tonic, stimulant, and laxative, and is popularly and efficaciously used for coughs, as an infusion, as a syrup with sugar, or as a candy. In England the name horehound is applied also to another plant, *Ballota nigra*, sometimes called black or fetid horehound, a fetid plant, also of the order Labiatæ, and of a genus very closely allied to Marrubium. It closely resembles the white horehound in taste, and possesses similar medical properties. A third British plant, *Lycopus Europæus*, a diandrous plant of the same natural order, is sometimes called water-horehound, and is also known as gypsywort. All these species have been introduced in the United States, and, in addition, six or eight species of Lycopus, or water-horehound, are rather abundant.



HOREHOUND.

HORGEN, hôr'gen. A town in Switzerland, on Lake Zürich, 10 miles south of Zürich (Map: Switzerland, C 1). It is a thriving industrial centre, with manufactures of cotton and silk goods, and chemicals. Population, in 1888, 5519; in 1900, 6883.

HOR'ICON. The Indian name of Lake George, N. Y.

HO'RITES. An ancient people who dwelt in and around Mount Seir before the Edomites came there (I. Chron. i. 38-42). Biblical tradition preserves a recollection that the Horites formed a group of seven tribes (Gen. xxxvi. 20-

30). They were smitten by Chedorlaomer and the kings of the East when they attacked Sodom in the days of Abraham (Gen. xiv. 6; Deut. ii. 12-22). They were overcome, and perhaps absorbed, by the Edomites. The name Horite has usually been explained to mean 'cave-dwellers,' but this is doubtful. See Edom.

HORI'ZON (Lat. *horizon*, from Gk. ὁρίζων, pres. part. of ὁρίζειν, *horizein*, to bound, from ὅρος, *horos*, boundary). (1) In popular language, the circular line formed by the apparent meeting of earth and sky. Astronomers call this the *sensible horizon*, distinguishing it from the *rational horizon*, i.e. the circle formed by a plane passing through the centre of the earth, perpendicular to the plumb-line, and produced to meet the heavens. (2) A term in geology, referring to a bed or beds which are characterized by some special forms of fossils found in them.

HORLA, ôr'lȧ', Le. A story dealing with madness, by Guy de Maupassant (1887), who himself became insane in 1892.

HORMAYR, hôr'mīr, Joseph, Baron (1782-1848). An Austrian historian, born at Innsbruck. He studied law at the University of Innsbruck, and afterwards entered the Ministry of Foreign Affairs at Vienna. In collaboration with Archduke John, he published a number of pamphlets against Napoleon, and in 1809, as intendant in the army commanded by John, he incited the popular uprisings in the Tyrol, Vorarlberg, and Salzburg. After the truce of Znaim he returned to Vienna and devoted himself to historical work until his unauthorized attempt to stir up another revolt among the Tyrolese led to his being arrested at Metternich's command. On his release the Emperor made him Court historiographer, but his imprisonment had so imbittered him against Metternich that in 1828 he accepted the position of Councilor in the Bavarian Ministry of Foreign Affairs. Four years afterwards he was sent to Hanover to represent the Bavarian Government, and in 1839 was transferred to Bremen, and then was given charge of the Government archives at Munich. His intimate connection with public men and events during one of the most interesting periods of European history gives a peculiar value to his writings, many of which deal with subjects of which he had a first-hand knowledge. His publications include: *Allgemeine Geschichte der neuesten Zeit, vom Tode Friedrichs des Grossen bis zum zweiten Pariser Frieden* (1817-19; 2d ed. 1831); the much criticised but highly entertaining *Lebensbilder aus dem Befreiungskriege* (1841-44); and *Das Land Tirol und der Tirolerkrieg von 1809* (1845).

HORMIZD, hôr'mīst, or **ORMAZD**. The name of several kings of Persia. See Sassanidæ.

HOR'MOGO'NIA (Neo-Lat. nom. pl., from Gk. ὅρμος, *hormos*, chain + γόνιμος, *gonimos*, productive, from γόνος, *gonos*, seed). Portions of the filaments of blue-green algæ that separate to form a new plant. See Cyanophyceæ.

HOR'MOS (Gk. ὅρμος, chain). A Greek war dance supposed to have been invented by Lycurgus. Like most of the other Greek dances, it was danced in a long line which wound in and out. The performers were youths and maidens, and the leader of the line played on a lyre to which the steps were timed. The figures which the men danced were wild and warlike, and they were followed by the girls, who danced gracefully and quietly, in contrast to the exaggerated steps of the men. The name was also applied to an ancient Scotch dance.

HORN (AS., Icel., OHG. *horn*, Ger. *Horn*, Goth. *haúrn*, Runic *horna*, horn; connected with Ir., Welsh *corn*, Galatian κάρνον, *karnon*, Lat. *cornu*, horn, and ultimately with Gk. κερας, *keras*, Skt. *śṛnga*, horn, as well as with Lat. *cervus*, AS. *heorot*, Eng. *hart*). (1) A modification of the cuticle observable in man and most other vertebrated animals; and (2) a special adaptation of this substance to form appendages of the head in certain mammals. The word has many other applications, more or less remote from this, in zoölogy as elsewhere. Thus the chitinous material of the harder parts of insects is frequently termed 'horn,' whereas the tortoise-shell, which is truly of this nature, is rarely so designated. The projections from the prothorax of 'stag' and other beetles, the feelers or ovipositors of other insects, the eye-stalks of snails, frontal feathers (plumicorns) of owls, the projecting front teeth of the narwhal, etc., are frequently called 'horns,' though all are different in both substance and function from the true horns to which this article is restricted.

Nature and Service of Horn. Horn is the connective tissue of the epidermis hardened and thickened, and in some cases mixed with, or composed of, agglutinated hairs. Its purpose is to form a resisting or protective surface, or a tough tool or weapon. The whole, or principal part, of the epidermis may become of this nature, as is the case in the hide of armadillos and the scaly ant-eaters, ancient and modern, in serpents and lizards (whose scales are horny), and in the turtles which supply tortoise-shell (q.v.). In the higher ranks it constitutes the 'whalebone' developed from the palate of the baleen-bearing whales; becomes the protective sheath of the mandibles forming the serviceable beaks of birds and turtles; and, by more or less completely ensheathing and extending the outermost bone of each digit, forms nails, claws, and hoofs (see Nail), strengthening and arming the fingers and toes of such reptiles as have feet, of all birds, and of all the mammals except whales. Horn enters also into spurs on the legs and other parts of certain animals, forms one or more shields, or weapons, or both, on the head; and callosities elsewhere, such as on the heel of man (and the 'corns' on his toes), the knees of camels, etc., as use and habit call for a hardening of the cuticle to resist wear and relieve pressure. Further particulars as to these structures will be found in the article Bird (the beak); Integument; Nail (nails, claws, hoofs, spurs, etc.); Skeleton; Snake (scales, rattle, etc.); Tortoise-Shell; Turtle; and under Horns. The chemical composition of the various horny tissues is exhibited in the table on the following page.

These tissues differ slightly in the quantity of inorganic matter which they contain, but the difference does not vary much beyond 1 per cent. Hair yields from 0.54 to 1.85 per cent. of ash, containing among other ingredients, peroxide of iron and a little silica. In feathers, the quantity of silica is very considerable, and it is doubtless to this constituent that the shaft in a great measure owes its strength and hardness.

Horny Tissue appears as a variety of tumor upon different regions of the human skin, but especially upon the face, and occasionally in dermoid cysts. These manifestations are considered as warts, of which the epidermal cells are intimately united in the same manner as in the nails; and they are classed with warts, corns, and some nævi, under the term corneous papillomata. The tendency to horny excrescences on the skin is rare, and belongs to advanced age. There is a disease of the skin called 'hystricismus,' which is a peculiar variety of papillary hypertrophy, with hornifying of the epidermis of such a nature that it resembles short porcupine-quills. Horny excrescences occasionally break and fall off spontaneously; but they grow again if not cured radically by the excision of the portion of skin upon which they are located.

	Hair	Horse's hoof	Cow's horn	Nails	Epidermis	Whalebone	Tortoise-shell
Carbon	50.65	51.41	51.03	51.09	50.28	51.86	54.89
Hydrogen	6.36	6.96	6.30	6.82	6.76	6.87	6.56
Nitrogen	17.14	17.46	16.24	16.90	17.21	15.70	16.77
Oxygen	20.85	19.94	22.51	22.39	25.01	21.97	19.56
Sulphur	5.00	4.23	3.42	2.80	0.74	3.60	2.22

Economic Uses of Horn. The horns of animals enter largely into the manufacture of many useful and ornamental articles, and are employed for useful and ornamental purposes. The principal horns employed are those of the ox, buffalo, sheep, and goat. These are quite different in structure from the antlers of various deer, which are really bone and resemble ivory in structure. More like true horns are hoofs, claws, nails, and quills. Horns have but 2 or 3 per cent. of earthy matter, while bones have over 50 per cent. Horn can be softened and split into thin layers or laminæ, or pressed into molds. As it recovers its peculiar character of flexibility, toughness, and transparency when cold, it is particularly adapted for a great variety of purposes. It can also be dyed various colors. A solution of gold in aqua regia dyes it red; a solution of nitrate of silver in nitric acid, black; a paste of red lead, made with a solution of potash, colors it brown; so that with a proper arrangement and application of these materials, the most admirable imitations of the much more costly tortoise-shell can be produced, which, indeed, it resembles in structure. The more common vegetable dye-stuffs, as logwood, Brazilwood, barwood, saffron, indigo, etc., will also color horn, but neither so permanently nor so brightly as the metallic materials.

By long-continued soaking, the horns of all the animals above mentioned can be softened, and those of the sheep and goat can easily be split into several layers after they have been soaked and boiled. These layers can not only be flattened out by putting them between smooth iron plates heated and placed in a press, but can be welded together firmly by pressing their edges together between polished copper plates, and then plunging them for some time into boiling water and then into cold water. This property enables the horn-worker to use up the smallest cuttings with profit. Another valuable property of horn is that when heated it can be pressed into a die, and not only takes a beautiful sharp impression, but if left in the die until cold it retains it. In this way it is employed in making handles for umbrellas, knives, forks, and a variety of other articles. Combs are made out of the flattened sheets, and beautiful carvings are made out of the solid parts of buffalo-horns. Ox-horns, too, are sometimes of fine quality and color, and are fashioned into drinking-cups and other articles, often highly ornamental. Before the horn is softened for manufacture, the solid tip is usually sawed off, to be treated separately. This is usually sawed into blanks to be used for buttons and other purposes. These blanks are heated, pared, heated again in water and pressed between dies, after which they are buffed and polished. The value of the horns and hoofs imported into the United States to be consumed in domestic manufactures in recent years has been as follows: 1893, $554,902; 1894, $235,232; 1895, $268,800; 1896, $568,445; 1897, $150,134.

HORN. A musical instrument, belonging to the family of brass wind instruments and distinguished by a cupped mouthpiece, a flaring bell, and a narrow, conical tube which is between nine and eighteen feet long, and is twisted back on itself. The natural or French horn (q.v.), although having an exceedingly tender, sonorous tone, was a very imperfect instrument, and is now entirely superseded by the valve horns. The horn is built in almost any key; there are horns in A, B♭, C, D, E♭, E, F, G. Its range is from C—c^3. As the horns (except the one in C) are transposing instruments, lower tones than C can be obtained by using different horns. For instance, on the low B♭ horn the note C sounds B♭, on the E♭ horn E♭, etc. The music for horns is always written in the G clef, except the very low tones. Strange to say, the tones written in the bass clef are always written an octave *lower* than the actual sound. In the smallest orchestra there are always two horns. The ordinary symphony orchestra has four, and Wagner employs as many as eight. When four horns are used the first and third are written on the same staff in the score, and the second and fourth together on another staff. What kind of horns are employed depends upon the tonality of the composition and also to some extent upon the modulation within the tonality. Thus a composer writing in C major might employ two horns in C and two in F, or two in C and two in G. Some modern masters use the F horns for all keys. A peculiarity in writing music for horns is that no key signatures are used. All music is written in C and every chromatic alteration is specially marked. Muted tones can also be produced upon the valve horns. They have a peculiar ominous sound, and are sometimes employed in dramatic works to express situations of fear, horror, mystery, etc. In the *Nibelungen* Wagner has an effective phrase on muted horns whenever Wotan's ravens are mentioned. Unfortunately, these muted tones have been abused and are used without sufficient reasons in the works of the Neo-German school. Of the early composers, Weber was preëminent for his skillful use of horns in producing new effects.

HORN, hôrn, Arvid Bernhard, Count (1664-1742). A Swedish statesman, born at Vuorentaka, Finland. He served in the Swedish Army, and was rapidly promoted to be general of brigade (1700). He assisted in the deposition of King Augustus of Poland (1704), and under Stanislaus Leszczynski, his successor, he remained as Ambassador. In 1705 he was made counselor to the King. After the death of Charles XII. he forced his sister, Ulrica Elinore, to submit to an election before she could ascend the throne, and later imposed on her the Constitution of 1719. The years when he was marshal of the Kingdom were spoken of afterwards as the 'time of Arvid Horn,' so successful had the country been under his leadership. He retired from active life in 1738.

HORN, Cape. See Cape Horn.

HORN, Charles Edward (1786-1849). An English composer and conductor, born in London. He was the pupil of his father, Karl Horn, a music-teacher, and received singing lessons from Rauzzini. He first appeared at the English Opera House in 1809. The following year he composed *The Magic Bride*, his first opera. From 1814 to 1832 he was connected with the English Opera House as singer, composer, and conductor. He made a prolonged visit to America in 1832, and conducted English opera in New York City. During this time the Handel and Haydn Society produced two of his works, an *Ode to Washington* (1832), and an oratorio, *The Remission of Sin* (1836). This latter, renamed *Satan*, was given in London in 1845. He was elected conductor of the Handel and Haydn Society in 1847, and reëlected in 1848. Among his works are: *Daniel's Prediction* (1848); several operettas, such as *Tricks upon Travelers* (1810) and *The Devil's Bridge* (1812); of his songs, "Cherry Ripe" and the duet "I Know a Bank" have remained popular.

HORN, Gustaf (1592-1657). A Swedish soldier, born at Oerbyhus. He studied at the universities of Rostock, Jena, and Tübingen, entered the army in 1612, and served against the Poles. In 1630 he commanded half the army of Gustavus Adolphus in the advance of that monarch upon Frankfort-on-the-Oder. He directed the Swedish left in the battle of Breitenfeld, in 1631, and participated in the defeat of Tilly's army on the Lech. In 1634 he was completely defeated, together with his ally, Bernhard of Weimar, at Nördlingen, and made a prisoner by the Imperialists. He was not released until 1642. He later distinguished himself in the war against Denmark.

HORN, Paul (1863—). A German specialist in modern Persian philology, born at Halle. His education was at the university in that city, where he devoted himself chiefly to Oriental and linguistic studies, and received the degree of doctor of philosophy in 1885. Four years later he became privat-docent at the University of Strassburg, and he has held a professorship there since 1900. Among his writings may be mentioned: *Die Nomenalflexion im Avesta und den altpersischen Keilinschriften* (Halle, 1885); *Sassanidische Siegelsteine* (Berlin, 1891); *Die Denkwürdigkeiten Schah Tahmâsp's* (Strassburg, 1891); *Neupersische Schriftsprache* (Strassburg, 1898); *Geschichte Irans in islamitischer Zeit* (Strassburg, 1900); *Geschichte der Persischen Litteratur* (Leipzig, 1902).

HORN, Van de, or van (1635-83). A Dutch buccaneer. After studying seamanship on board of merchant vessels, at the age of twenty-four he bought one of his own, set up as a pirate, and preyed upon the shipping of his native land. Next he became a sailor of fortune, serving whichever European power would pay him most highly, and it was chiefly France that engaged him to wage war upon Spanish ships by fair means or foul, generally the latter. He was with De Graff in the despoiling of Vera Cruz (1683), but fought a duel with him over the division of plunder and died from the results of the wound thus received.

HORNBEAM (*horn* + *beam*, AS. *beam*, OHG. *boum*, Ger. *Baum*, tree; connected ultimately with Gk. *φύειν*, *phyein*, to grow, Skt. *bhū*, to become), *Carpinus*. A genus of the natural order Cupuliferæ, which consists of trees with compact, rough, hard wood, almost smooth whitish-gray bark, deciduous leaves, and monœcious flowers. The common hornbeam (*Carpinus betulus*), very frequent in moderately moist, shady woods of many parts of Europe, is a beautiful tree which attains a height of 60 to 100 feet. It has ovate, acuminate, almost triply serrate leaves, and the fruit has very large, deeply three-partite bracts. Its root descends deep into the ground. The wood, which is much used by carpenters and wheelwrights, is white, very hard, uncommonly strong and tough, and therefore suitable for bearing heavy strains. It takes a very fine polish, and, when well stained, might readily be mistaken for ebony. In the earth, or where exposed to the changes of the weather, it is not very durable. It burns readily, and is one of the best kinds of firewood; it affords an excellent charcoal, and the ashes yield much potash. The young stems, by reason of the dense growth of their twigs, are very suitable for forming live fences and bowers; and as it bears clipping well, the hornbeam was often employed to form live walls formerly fashionable. The genus is represented in North America by *Carpinus Americana*, a small tree 25 to 40 feet high, which occurs from Quebec to Florida and west to Minnesota and Texas. Its wood is very hard, dense, and heavy, and is one of the toughest woods of the Northern States. It is known as hornbeam, blue beech, water-beech, and ironwood. The hop-hornbeam (*Ostrya Virginiana*) is of much the same habit, range, and properties. It is of slow growth and is seldom planted, although a very ornamental tree. This tree is also known as ironwood and leverwood.

HORNBILL. The name of an African and East Indian family of large birds, forming the family Bucerotidæ, and remarkable for the enormous size of the bill, and for a large bony protuberance (epithema, or casque) with which it is usually surmounted. The bill is curved, broad at the base, compressed toward the tip, the bony protuberance on the upper mandible assuming different forms in different species. Two subfamilies are recognized—the Bucoracinæ (or Bucorvinæ) and the Bucerotinæ. The former are African, have the casque hollow, and are of terrestrial habits. They are described under Ground Hornbill. The latter contain the 'true' or typical hornbills, of which there are many genera and species scattered over Northwestern Africa, India, and the Oriental region. All are rather large birds, the biggest five feet in length from the tip of the beak to the end of the tail; have long, full tails, and strong feet, fitted for arboreal habits. Their colors are mainly black and white; the great bills are yellow, often strongly marked with red and black. They are omnivorous, and in captivity show an ostrich-like voracity, swallowing anything offered, bones and all. The food is always caught in the tip of the bill, then tossed into the air and recaught. In nature they feed largely upon flowers and fruit, cut from their fastenings by the saw-edged beak. Their flight is slow and heavy, but it may be long sustained. It is said to be very noisy, the sound of the wings of a large hornbill being audible for a mile, and when two or three are flying together the noise is said to resemble a steam-engine.

Breeding Habits. Some, if not all of the species, have the remarkable habit of imprisoning the female during incubation. This is done by stopping up the entrance to the nest, which is in a hollow tree, with mud or excrement. There seems to be some doubt whether it is done from the outside by the male, using mud, or from the inside by the female, using her own excrement. Perhaps the method differs in different species. In any case, a small opening is left through which the female can extend her bill and secure the food which the male brings. Such nests are an excellent protection against enemies, and are said to be used repeatedly. The young are born naked.

This remarkable method of nidification is connected with a strange feature of bird economy first noticed and studied by Bartlett, who shows (*Proceedings Zoölogical Society of London*, 1869) that hornbills, at intervals, cast the epithelial layer of their gizzards—a layer formed by the secretions of certain glands. This is ejected entire in the form of a bag, the mouth of which is closely folded, and which is filled with the fruit the bird has been eating. Whether these castings form a nutritious and partly digested supply of food for the sitting female is not known. Consult Newton, *Dictionary of Birds*, London, 1896.

Species. The bird ordinarily presented as 'the' hornbill is *Buceros rhinoceros*, from the East Indies, which was known and quaintly described, from preserved heads alone, by Pliny and the naturalists of the Middle Ages. A closely allied species of Java (*Buceros sylvestris*) is shown on the accompanying plate. Another style of casque, the flat table, is shown in Figure 1 of the plate (*Hydrocorax planicornis*, of the Philippines), which illustrates almost equally well the 'homurai' of India (*Dichoceros bicornis*), whose plate-casque is bent into a trough, and terminates in two horns in front. This familiar species is found eastward to Sumatra, where also, among other kinds, lives that solid-casqued one (*Rhinoplax galeatus*), out of whose 'helmet' ivory-like ornaments are carved. This seems to be a remarkable species in several ways. Another curious form of beak is that of the Papuan *Phylidoceros plicatus*, in which the top of the bill has numerous curving transverse folds. Prominent among African genera are the trumpeter hornbills, one species of which is the 'crested' (*Bycanistes cristatus*). Here the beak is comparatively short. In some genera the bill approaches the shape of a toucan's, and has little or no casque. A history of the family, with colored plates, by D. G. Elliot, entitled *Monograph of the Bucerotidæ*, was published in London in 1882. An excellent popular account is given in the *Royal Natural History* (London, 1895). See Plate of Hornbills and Toucans.

HORNBILL CUCKOO. A channelbill (q.v.).

HORNBLENDE (*horn* + *blende*, Ger. *Blende*, from *blenden*, to blind). A greenish-black or black variety of amphibole that crystallizes in the monoclinic system, and is a ferrous magnesium-calcium-aluminum silicate. It is found both in crystals and granular masses. Hornblende is a common constituent of various igneous rocks, such as granite, syenite, diorite, and those of more basic composition. Hornblende schist and hornblende slate are varieties of rocks that contain hornblende with more or less feldspar, quartz, or mica. The black crystallized varieties of hornblende are sometimes called *schorl*, and may be cut into ornaments.

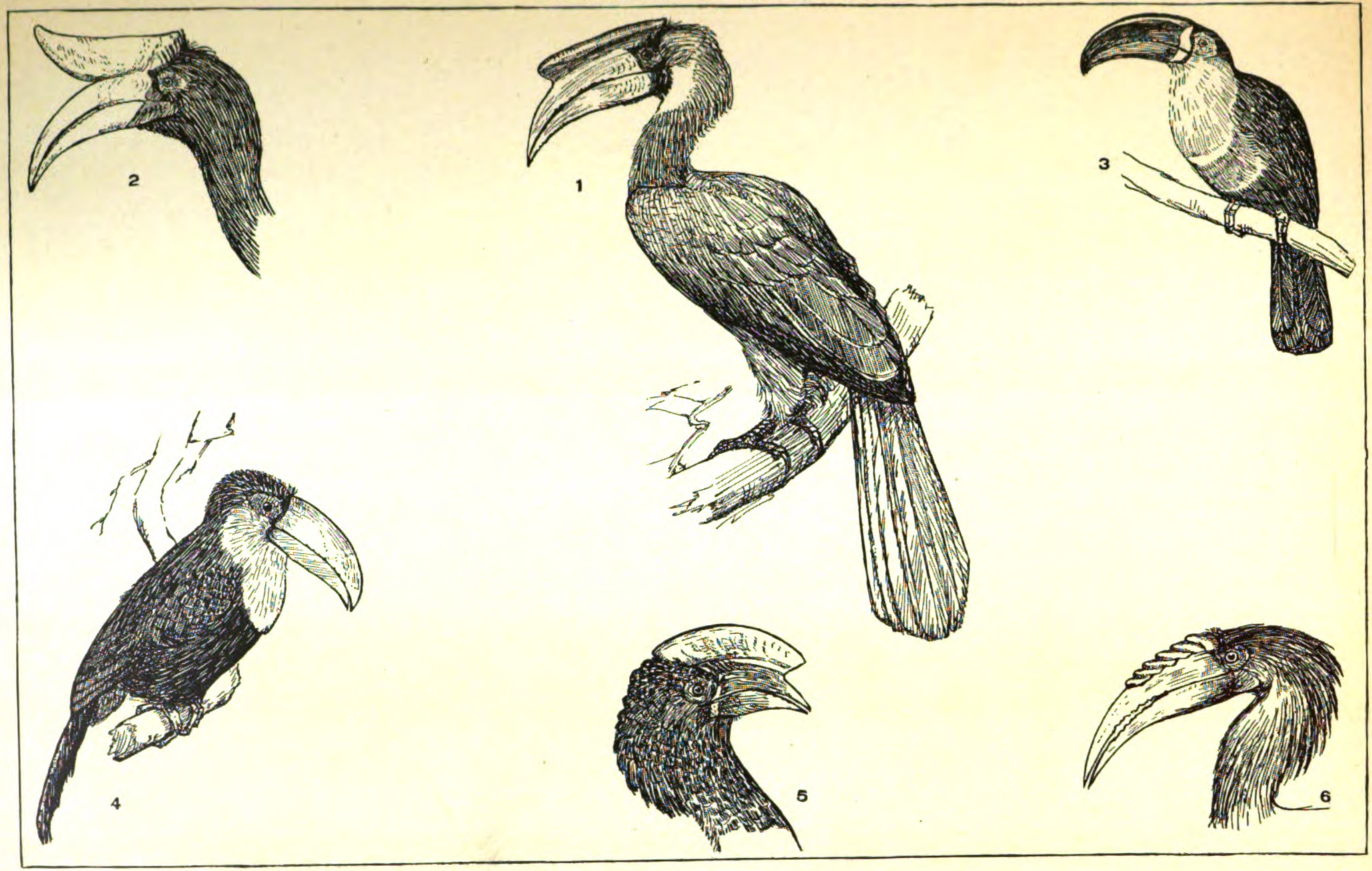
HORN'BLENDITE. An igneous rock of granitic texture very largely composed of hornblende. Hornblendite occurs in the so-called Cortland series of eruptives in the Highlands of the Hudson River, near Peekskill, N. Y.

HORNBLOWER, or Horn-Worm. A local name in the Southern United States for the tobacco-worm (*Protoparce Carolina*). See Tobacco Pests.

HORNBOOK. The primer for learning the elements of reading, used in England before the days of printing, and common down to the time of George II. It consisted of a single leaf, containing on one side the alphabet large and small, in black letter or in Roman, often followed by a number of monosyllables. Then came a form of exorcism and the Lord's Prayer, and the Roman numerals. The leaf was usually set in a frame of wood, with a slice of transparent horn in front; hence the name. There was a handle usually with a hole for a string, whereby the apparatus was slung to the girdle of the scholar. Sometimes the leaf was simply pasted against a slice of horn. At first the leaf was of vellum, with the characters in writing; later, of paper, and printed. The hornbook was prefaced and ornamented with figures of the cross, and hence came to be often called Christcross-row, or Crisscross-row. Common as hornhooks at one time were, copies of them are now exceedingly rare. Consult Tues, *History of the Hornbook*, with illustrations and facsimiles (London, 1897).

HORN'BY, Sir Geoffrey Thomas Phipps (1825-95). An English admiral, son of Admiral Sir Phipps Hornby (1785-1867), born at Winwick, Lancashire. He entered the navy when he was twelve; was present at the bombardment of Acre; served under Wyvill hunting slavers (1844-46) and under his father in the Pacific (1846-50); and was sent to Hong Kong (1858) and took the *Tribune* to Vancouver's Island, then disputed property, and to all appearances the probable source of open war. He became vice-admiral and Lord of Admiralty in 1875, and two years afterwards was put in command of operations in the Mediterranean. In February, 1878, he 'proceeded to Constantinople,' in spite of the protests of the Turkish Government, and prepared to meet any

HORNBILLS AND TOUCANS



1. FLAT-CASQUED HORNBILL (Hydrocorax planicornis); male.
2. RHINOCEROS HORNBILL (Buceros rhinoceros).
3. ARIEL TOUCAN (Rhamphastos ariel).
4. MEXICAN TOUCAN (Rhamphastos carinatus).
5. CRESTED TRUMPETER HORNBILL (Bycanistes cristatus).
6. PAPUAN WREATHED HORNBILL (Phylidoceros plicatus); male.

attack on the city by Russia. He was made an admiral (1879), president of the Royal Naval College (1881-82), and Admiral of the Fleet (1888). Consult the life by his daughter, Mrs. Edgerton (London, 1896).

HORNE, George (1730-92). An English bishop, born at Otham. He was educated at Oxford, and spent the greater part of his life there, becoming principal of Magdalen College in 1768, and in 1776 vice-chancellor of the university. He was made Dean of Canterbury in 1781, and in 1790 Bishop of Norwich. His only important work, *A Commentary on the Psalms* (1771), exhibits a deep acquaintance with Hebrew and biblical lore, and is marked by a spirit of earnest piety. He wrote many pamphlets against such antagonists as Sir Isaac Newton, Hume, Adam Smith, and David Law, all of whom he ludicrously underrated. He adopted the views of John Hutchinson (q.v.), and wrote in his defense.

HORNE, Richard Hengist (1803-84). An English author. He was born in London; received a military education, and served as a midshipman in the Mexican Navy during the war of that country with Spain. After a few years spent in adventurous wanderings, he returned to England, and from 1828 devoted himself to literature. In 1837 he published two tragedies, *Cosmo de Medici* and *The Death of Marlowe*. But he is best known as the author of *Orion: An Epic Poem* (1843). During the period 1839-46, he carried on a correspondence with Elizabeth Barrett (afterwards Mrs. Browning), and her letters to him were afterwards published in two volumes in 1877. A report prepared by him on the employment of children in mines and factories inspired Mrs. Browning's *Cry of the Children*. Going to Australia in 1852, he served as a gold-fields commissioner and a magistrate, and published *Australian Facts and Figures* (1859). Returning in 1869, he wrote thereafter a number of books, few of which were of any special note.

HORNE, Thomas Hartwell (1780-1862). An English Bible scholar. He was born in London, October 20, 1780, was educated at Christ's Hospital, and became clerk to a barrister. His leisure hours were devoted to study and to miscellaneous literary labors. In 1818 he published his *Introduction to the Critical Study and Knowledge of the Holy Scriptures* (11th ed. 1860), a work which procured for him admission into orders without the usual preliminaries. In it he presented the results of seventeen years of hard work. In 1824 he became senior assistant librarian in the department of printed books in the British Museum. In 1831 he became a prebendary of Saint Paul's Cathedral; in 1833 rector of the united parishes of Saint Edward the King and Martyr and Saint Nicolas Acons, London. He resigned his assistant librarianship in 1860. He died in London, January 27, 1862. Consult his life by his daughter, Mrs. S. A. Cheyne (London, 1862).

HORNED DACE. A fish. See Dace.

HORNED FROG. One of the large toad-like South American frogs of the genus Ceratophrys, especially *Ceratophrys cornuta*, which has horn-like protuberances on the head. It is one of the most beautiful frogs known. The ground colors are black, brown, and green, with an orange stripe over the head and back; and these colors are irregularly and most pleasingly arranged and blended. Various other gaudy and interesting species are known in the American tropics. See Colored Plate of Frogs and Toads, under Toad.

HORNED GREBE. See Grebe.

HORNED LARK. See Shore-Lark.

HORNED OWL. Any owl with plumicorns, that is, tufts of upright feathers on the top of the head which simulate horns. The eagle owls (q.v.) are thus distinguished, and their American representative is commonly called the 'great horned owl.' Other horned species are mentioned and illustrated under Owl.

HORNED PHEASANT. A sportsman's name in India for the tragopans (Ceriornis), especially the black-headed species (*Ceriornis Satyrus*), common in the Eastern Himalayas.

HORNED POUT. See Bullhead; Catfish.

HORNED RATTLESNAKE, or Sidewinder. See Rattlesnake.

HORNED SCREAMER. A bird. See Screamer.

HORNED TOAD, or Horned Frog. The common name of several short-legged, depressed, toad-like horny lizards, all of which occur in North America. According to Cope and others there are two genera, Phrynosoma and Anota, containing eleven species, eight of which occur in the United States. Anota differs from Phrynosoma only in the fact that the tympanic drum is concealed by a scaly integument. Horned toads range from British America into Mexico. They feed mainly on insects, which they capture with a rapid thrusting out of their mucilaginous tongues. They are sluggish, harmless lizards, with little power of self-defense save their pointed scales, which, when bristled up, are a disagreeable mouthful for snakes, their most formidable foes. They will, however, fight and even kill a snake small enough to be an even match. Some of the species are said to squirt blood from the eyes when much irritated. The majority of the species are desert inhabitants, and escape pursuit by hiding beneath the prickly agaves, yuccas, and cacti of the plains. Other species live in cedar and pine belts. Both those forms that live on the bare stones or sand of the plains and those that occur in the pine belt are remarkably well protected by resemblance to their background. The young, a dozen or more at a time, are born from eggs, which are laid by the mother only an hour or so before they are ready to hatch. When the little ones emerge they are able to begin at once to catch and eat minute insects. Both young and old make interesting pets, largely because of their amusing irascibility, and can be taught to take flies from the hand, and do other simple things. See Lizard; and Plate of Iguana and Other American Lizards.

HORNED VIPER. See Viper.

HOR'NELLSVILLE. A city in Steuben County, N. Y., 91 miles southeast of Buffalo, on the Canisteo River, and on the Erie and other railroads (Map: New York, C 3). It has a free academy, a public library of 10,000 volumes, and public parks; and manufactures brick, silks, white goods, railway supplies, furniture, leather, sash, doors, and blinds. The government is administered under a revised charter of 1890, which provides for a mayor, elected biennially, in whose power, subject to the consent of the council, rest the appointments to subordinate offices; and a unicameral council. Settled in 1790, Hornellsville was part of Canisteo, and was called Upper Canisteo until 1820, when it was incorporated as a separate town under its present name, given in honor of Judge George Hornell, who was prominent in the town's early history. Population, in 1890, 10,996; in 1900, 11,918.

HORN'ER, Francis (1778-1817). A British statesman and political economist. He entered Edinburgh University in 1792, but left before finishing his course to take up the study of law, and was called to the Scotch bar in 1800. Later, in 1807, after a course at Lincoln's Inn, London, he started practice in the western circuit of England. Elected to Parliament in 1806, he sided with the Whigs, gaining special prominence in the debates on questions of finance and political economy. Horner was very much interested in the 'bullion' question which arose in 1810, and was chairman of the committee which drew up the first report on the subject. The recommendations embodied therein failed of adoption, but as a result of his influence, restrictions were placed upon the issue of paper money, thus paving the way for the success of Peel's Currency Reform Bill in 1841. Horner was one of the three original founders of the *Edinburgh Review*, to which he was a frequent contributor. Consult Horner, *Memoirs and Correspondence of Francis Horner* (Boston, 1853).

HORNER, William Edmonds (1793-1853). An American physician, born in Warrenton, Va. He graduated at the University of Pennsylvania in 1814, was surgeon for a time in the United States Navy, and from 1831 until his death was professor of anatomy in the University of Pennsylvania. In 1847 he founded Saint Joseph's Hospital. In 1824 he announced the discovery of the muscle (tensor tarsi) known as 'Horner's muscle.' He published a number of medical works, including: *Pathological Anatomy; Practical Anatomist* (1856); *Special Anatomy and Histology* (8th ed. 1851); *The United States Dissector* (5th ed. 1856); and superintended the preparation of an *Anatomical Atlas* by Henry H. Smith (1844).

HORNER, William George (1786-1837). An English algebraist. He was educated at Kingswood School, near Bristol, and afterwards became master there. He also established a school at Bath (1809), where he remained until his death. He had no university training, and was not a profound mathematician. He is known solely for his discovery of the ingenious algorism for approximating the roots of higher numerical equations, which was made known in a paper read before the Royal Society in 1819, and published in the *Philosophical Transactions*. The process is commonly known in England and America as *Horner's method*, and may be found in any higher algebra. Related to it is a process of synthetic division which also bears his name.

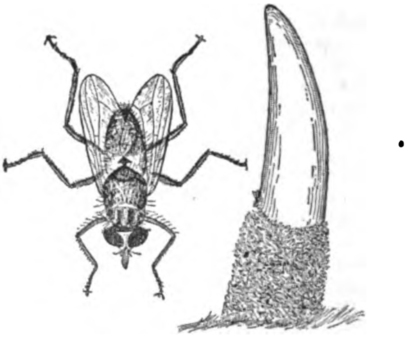
HORNES, Philip, Count of. See Hoorne.

HORNET (AS. *hyrnet*, *hurnitu*, OHG. *hornuz*, *hornaz*, Ger. *Horniss;* connected with Lat. *crabro*, OChurch Slav. *srŭshenĭ*, Lith. *szirszone*, hornet, OChurch Slav. *srŭsha*, Lith. *szirszŭ*, wasp; less plausibly connected with *horn*, either from its antennæ or from its buzzing sound). A name applied to several large stinging insects belonging to the family Vespidæ and genus Vespa. They differ from Polistes, the other common genus of this family, in having larger, thicker bodies, and always inclosing their nests with a grayish paper covering. In color, they are usually black or dark brown, conspicuously ornamented with white or yellow. The hornet builds its nest, which is in the form of a number of combs placed one above another, in a hole in the ground, or in the open, attached to the branches of a tree, or under the eaves of buildings. Its manner of constructing the nest and caring for the young is the same as that described elsewhere under the title Wasp. It is among the most voracious of insects, eagerly laps up all sorts of sweets, and seizes and devours other insects of various kinds. One of the most common species in the United States is *Vespa maculata*, which builds its great nest in the branches of trees. It is very vigilant, and especially irritable when attending to the duties of its nest, but it may often be found hibernating in the autumn and winter in decaying wood, when it may be handled with impunity.

The European hornet (*Vespa crabro*) has been accidentally introduced into the United States, and has established itself in the vicinity of New York City. Its spread has been very slow, and although its original introduction and establishment must have taken place many years ago, it is still apparently restricted to an area of little over 100 miles square. See Wasp; and consult the authorities there referred to.

HORNE-TOOKE, John. See Tooke.

HORN-FLY. A European fly (*Hæmatobia serrata*), which was imported into the United States about 1888, multiplied with excessive rapidity, and soon spread over the entire country. It breeds in cow-dung, and with very great rapidity and prolificacy. It is a biting fly, and greatly annoys cattle. The name 'horn-fly' is derived from a habit which the flies have of clustering in great numbers so as to form black bands around the bases of the horns of cattle. They do not damage the horns, as has been supposed, but simply rest in this location, where they cannot easily be reached by the cow. Consult: Lintner, "The Cow-Horn Fly," in *The Country Gentleman* (London, 1897); Parrot, "Horn-Fly Remedy," in the *Kansas Farmer* (Topeka, 1899); Osborn, *Insects Affecting Domestic Animals* (Department of Agriculture, Washington, 1896).



HORN-FLY.

The adult horn-fly; and a cow's horn about the base of which is clustered a swarm of the flies.

HORNING, Letters of. In Scotch law, a writ which issues to compel a party to execute or carry out a judgment or decree of the court. The writ was formerly the only form of enforcing civil decrees by imprisonment, except in the case of small debt decrees. The process has been shortened, and other forms of execution are now more commonly employed. The title of the writ is derived from the ancient custom of denouncing a person disobeying the writ with three blasts of a horn. This was technically called 'putting him to the horn.'

HORNITOS, hôr-nē'tōz, or **HORNOS** (Sp., little ovens). The name given to the low oven-shaped hillocks which emit smoke and vapors, and which occur in great numbers on the sides and in the neighborhood of the large volcanoes of South America.

HORNPIPE. See Black Gum.

HORNPIPE. A lively English dance, originally in $\frac{3}{2}$, later in $\frac{4}{4}$ time. The universal peculiarity of the music was the length of the final note in each phrase. Its history can be traced back to the sixteenth century in England, and to about 1740 in Scotland. During the eighteenth century it was widely popular, but since then it has been distinctively a sailor's dance.

HORNS. Under this term are commonly confused two very distinct structures forming outgrowths on the head of ungulate animals, to which order they are confined. The word ought not, strictly, to include the bony antlers of deer or the giraffe, since these, although to a certain extent epidermal outgrowths, consist of true bone built up from blood deposits, and are not at all transformed cuticle or 'horn.' Nevertheless, as Beddard points out (in *Mammalia*, London, 1902), the difference is one of degree rather than of kind. The simplest condition is seen in the giraffe, each of whose paired horns is a straight, bony outgrowth, the os cornu, originally separate from the skull, but becoming permanently fused with it early in life, and is covered with wholly unmodified furry skin. In deer there is the same os cornu, which may here be branched, and never becomes fused with the skull, but, on the contrary, is shed and renewed annually, and is covered with a skin modified into 'velvet' (see Deer) which decays and drops off as soon as the horn-core (antler) is perfected. Between these two falls possibly the extinct Sivatherium (q.v.), and certainly the modern pronghorn (q.v.). Here the bony core (os cornu) is fixed as in the giraffe, but begins to be branched as in the deer; and it is covered by a sheath formed of agglutinated hairs, the hairy skin beginning from the tip of the horn and proceeding downward, gradually transforming into perfect horn, which is shed and renewed annually. This is an isolated case, but connects the giraffe and deer with the Bovidæ, or proper 'hollow-horned' ruminants (Cavicornia). In this family the males of every species, and in most cases the females also, possess upon the top of the skull protuberances of bone into which air-cells often extend from the frontal sinuses. These are called 'horn-cores,' and form the support of the cornubus sheaths that cover and often extend far beyond them. They are not present at birth, for obvious reasons, but begin to grow immediately afterwards. The horn-sheaths grow with them, and continue even after they have reached normal size to push out at the base as fast as they wear away at the tip. Their form and position on the head is characteristic of each group: round and lateral in the oxen; slender, retrocurved or twisted, and somewhat compressed or sharply keeled in most antelopes; heavy, cross-ridged, triangular in section, and often spiral in the sheep and goats, and so on.

Evolutionists regard horns as, in most cases, a secondary sexual character. An examination of the fossil history of the tribe shows that these appendages have been gradually acquired, and it is only recently that the females of many forms, now provided with small horns, have acquired them by heredity. Moreover, castration or injury to the reproductive organs is likely to affect the growth and size of the horns. Lastly, among the deer, where the does (except in the reindeer) are hornless, these appendages are acquired just previous to the mating season and are dropped when the breeding season is over. Their service as weapons of defense and offense is, therefore, largely, if not primarily, in contests with each other for the supremacy of the herd—that is, in the combative process of sexual selection. They are, nevertheless, in many instances, powerful weapons in resisting and attacking outside enemies. The spear-like thrusts of the lowered horns of an enraged sable, or other large, long-horned antelope, are feared even by lions and leopards, which more than once have been killed by them. The goring power of a bull is irresistible. A heavy sheep, armed with its great horn-coils, is a 'battering-ram,' indeed, not to be despised. Many, however, seem to be ornaments rather than weapons of value; or tools helpful in various ways, as snow-shovels, for one pertinent example, among the reindeer. Some of the great extinct ungulates of Tertiary time had very powerful horns, especially Coryphodon and the group of great Dinocerata, where in some cases a pair upon the forehead was supplemented by one or a pair on the snout. At present, a ruling distinction between the artiodactyls and perissodactyls is, that in the former the horns are always paired (in one modern case, Tetraceros, two pairs) and on the forehead; while in the latter they are set on the nose, and are single or two in number, one behind the other. This is the case with the rhinoceroses (of which one very early form only had a paired arrangement), where the horn is a growth from the skin of the nose, composed of a solid mass of agglutinated hairs, based upon a knob of the underlying nasal bones.

HORN'SEY. A suburban municipality of London, England, six miles north of Saint Paul's (Map: London, C 7). It is a favorite holiday resort of Londoners, contains several parks, a public library and branches, museum, and public baths. The administration is progressive and provides artisans' dwellings, cottage allotments, etc. Population, in 1891, 44,523; in 1901, 72,000.

HORN-SNAKE. See Hoop-Snake.

HORNSTONE. A variety of quartz, resembling flint, but more brittle, and having a structure that is more splintery. See Quartz.

HORNTAIL. One of a group of hymenopterous insects forming the superfamily Siricoidea, ranked by early writers as a series—Xylophaga, the wood-eaters. They are distinguished from the saw-flies by the fact that the fore shanks have only one spur at the tip instead of two. They are called 'horntails' because the end of the body with the adults usually bears a spine or horn. The ovipositor is fitted for boring, and the eggs are usually laid in the woody tissue of trees and plants. The larvæ feed beneath the outer bark. The group is not a large one, but contains a number of common and interesting species in the United States. The large 'pigeon tremex,' for example, is often a rather serious enemy to certain shade-trees, such as the elm, sycamore, oak, and maple. The holes of this borer may be recognized by their regular, evenly cut shape, about the diameter of a lead pencil. Another species is known as 'the willow-shoot horntail' (*Phyllœcus integer*) and does much damage by ruining the terminal shoots of osier willow plantations in parts of the United States. The families included in this group are the Oryssidæ, Siricidæ, Xyphydridæ, and Cephidæ. Consult: Howard, *The Insect Book* (New York, 1901); Comstock, *Manual for the Study of Insects* (Ithaca, 1895).

HOR'NUNG, ERNEST WILLIAM (1866—). An English novelist, born in Middlesborough, Yorkshire. He passed two years (1884-86) in Australia. In 1893 he married a sister of Conan Doyle. After returning to England he began a series of adventure novels dealing mostly with criminal life in Australia. Among his novels are: *A Bride from the Bush* (1890); *Under Two Skies* (1892); *Tiny Luttrell* (1893); *Irralie's Bushranger* (1896); *The Rogue's March* (1896); *The Amateur Cracksman* (1899); *Dead Men Tell No Tales* (1899); *The Belle of Toorak* (1900); *The Fate of Faustina* (1901); *The Shadow of a Man* (1901); and *The Shadow of the Rope* (1902).

HORNYHEAD. One of the most widespread and numerous of American minnows (*Hybopsis Kentuckiensis*). It is a graceful, highly colored fish, six to nine inches long, the fins all pale orange without a black spot; and the males in spring marked with a crimson spot on each side of the head. The distinguishing feature, however, is the tubercle-covered crest on the top of the head of the adults, and especially of the males in nuptial dress. It is a congener of the silver chub, and is known as 'river chub,' or 'jerker,' in some places.

HORODENKA, hŏ'rô-dĕṉ'kȧ. A town in the Austrian Crownland of Galicia, on an affluent of the Dniester, 33 miles north-northwest of Czernowitz (Map: Austria, J 2). It has an agricultural school, linen-weaving factory, potash and soap works, and considerable trade in cereals. Population, in 1890, 11,162; in 1900, 11,615.

HOROL'OGY (from Lat. *horologium*, Gk. ὡρολόγιον, from ὡρολόγος, *hōrologos*, telling the hour, from ὥρα, *hōra*, hour + λόγος, *logos*, word, from λέγειν, *legein*, to say). That branch of applied science that has for its object the measurement of time. Although it is easy to look back on a period when time, according to the modern conception of it, as measured by hours, and minutes, and seconds, was unknown, yet we find progress early made in the measurement of larger periods of time, by observations of the heavenly bodies; and although, in the later progress of astronomy, it is found that the movements of the more conspicuous heavenly bodies do not afford accurate marks for the equable measurement of time, they were, for practical objects, sufficient, and afforded at least a better measure of time than any other phenomena which came under the observation of mankind. Thus, time was early divided into years, according to the motion of the sun among the constellations; into months, according to the motion of the moon relatively to the sun's place in the heavens; and into days, by the alternate light and darkness caused by the rising and setting of the sun. It was long, however, before any accurate measure was found for a division of the day itself. The earliest measure employed for this purpose that we can trace is the shadow of an upright object, which gave a rough measure of time by the variations in its length and position. This suggested the invention of sun-dials. Another means early adopted for the measurement of short periods of time was by the quantity of water discharged by dropping from one vessel into another. Instruments for the measurement of time on this principle were called clepsydræ (q.v.). The running of fine sand from one vessel into another was found to afford a still more certain measure, and hence the invention of the hourglass (q.v.). King Alfred is said to have observed the lapse of time by noting the gradual shortening of a lighted candle. It is not very easy to trace to its source the history of the invention to which the modern clock owes its parentage; the earliest clock, however, of which we have a complete description, and perhaps the earliest which attained any distinct superiority over the rude contrivances already mentioned, was the clock of Henry Vic (De Vick or De Wyck), a German, erected in the tower of the palace of Charles V., King of France, in 1379.

For the description of this first mechanical timekeeper, and for the subsequent history of clock and watch making, see CLOCK; WATCH; PENDULUM; ESCAPEMENT. The history of the science of horology and of the mechanical art of the clock, watch, and chronometer maker are so intermingled that they cannot be considered separately. They may, therefore, be found under these heads. See also TIME, STANDARD; TRANSIT INSTRUMENT.

HOROSCOPE (Fr. *horoscope*, from Lat. *horoscopium*, from Gk. ὡροσκοπεῖον, *hōroskopeion*, ὡροσκόπιον, *hōroskopion*, horoscope, from ὡροσκόπος, *hōroskopos*, one who observes the hour of a birth, from ὥρα, *hōra*, hour + σκοπεῖν, *skopein*, to view). In astrology, strictly speaking, that part of the ecliptic which is ascendant or rising in the east at the moment of an occurrence whose outcome is to be calculated, such as the birth of a child; thence, more generally, the figure of the heavens, constructed with this as starting-point, on which the subsequent predictions are to be based. See ASTROLOGY.

HORR, ROSWELL G. (1830-96). An American journalist and campaign speaker, born in Waitsfield, Vt. He graduated at Antioch College (Ohio) in 1857, served as clerk of the Court of Common Pleas of Lorain County, Ohio, from 1857 to 1863, and was subsequently admitted to the bar. He spent some years in mining in Missouri, and in 1872 resumed his law practice at Saginaw, Mich., where, in 1878, he was elected to Congress as a Republican. He was reëlected in 1880 and 1882, and after 1884 became one of the best known campaign speakers in the Republican Party, touring the country from Maine to California in the Presidential campaigns of 1884, 1888, 1892, and 1896, and attracting particular attention by his joint debates with Senator Stewart, of Nevada, in 1893, and with 'Coin'

Harvey in 1895. In 1891 he became a staff writer on the New York *Tribune*, to which he contributed over his name notable articles on the tariff and currency questions.

HORROCKS, JEREMIAH (c.1617-41). An English astronomer, born at Toxteth Park, near Liverpool. He entered Emmanuel College, Cambridge, in 1632, and remained there until 1635, devoting himself principally to the study of astronomy. In the latter year he returned to Toxteth and commenced, under extremely unfavorable circumstances, his original observations. In 1639 he was appointed to the curacy of Hoole, Lancashire, and in that village, on November 24, 1639 (O.S.), he made his famous observation of the transit of Venus—the first observation of this phenomenon ever made. Hearne, in his memoranda, tells us how Horrocks was called away, during his observation of the transit, "to his devotions and duty at church," the day being Sunday. Newton, in the *Principia*, bears honorable testimony to the value of Horrocks's astronomical work, especially commending his lunar theory as the most ingenious yet brought forward; adding, "and if I mistake not, the most accurate of all." Horrocks is frequently mentioned by the scientific men of the seventeenth century; the observation of the transit is by no means regarded as the most important of his astronomical achievements. He died suddenly at the age of about twenty-three, on January 3, 1641. Hevelius printed Horrocks's Latin treatise entitled *Venus in Sole visa* in 1662. In 1672 Horrocks's fragmentary works were published under the auspices of the Royal Society, being edited by Wallis, with the title *Jeremiæ Horroccii Opera Posthuma*, etc. Other works of Horrocks's perished in manuscript.

HORSA. See HENGEST.

HORSCHELT, hôr'shĕlt, THEODOR (1829-71). A German painter, born in Munich. He was a pupil of the Munich Academy and of Albrecht Adam. He began with studies of horses, and afterwards painted military pictures. Among these first is "The Poacher" (1850). He then went to Spain and Algiers, and afterwards took part in the Caucasian campaign of 1858-59, and made some of its episodes the subjects of his pictures, such as: "The Seizure of Shamyl," "Taking of the Citadel on Mount Gunib," and "Cossacks Returning from a Razzia." His many water-colors of Spanish and Algerian scenes show the same vigor and spirit.

HORSE (AS. *hors*, OS., Icel. *hross*, OHG. *ros*, Ger. *Ross*; possibly connected with Lat. *currere*, to run, less probably with Skt. *kūrd*, to spring, Gk. *κόρδαξ*, *kordax*, wanton dance, or with AS. *hrĕodan*, OHG. *rusten*, Ger. *rüsten*, to adorn). One of a genus of pachydermatous quadrupeds of the family Equidæ (q.v.). Since the domestication of the horse it has become next to man himself the most important factor in the business and pleasures of the world, and in fact all the practical details of every-day human life. According to the monuments, the horse was introduced into Egypt at the time of the shepherd kings. His use, however, was very limited, both the Egyptians and Assyrians confining the use of the horse to warfare. Subsequently, however, his services to man increased, and he became an emblem of rank and an object of luxury or sport, as well as an aid in war.

The speed of a horse is its greatest asset, because it is its chief value to man. It is the recognition of this value that has been the important factor in the evolution of the horse, an animal especially plastic in the hands of the breeder. His size, form, action, and instincts are subject to modification to a degree unknown in that of any of the other larger species. During his early history modifications of type were due to the changing conditions of warfare; but to-day the principal variations of type are, to a far greater extent, due to the exigencies of commerce, or the demands of sport. It has been suggested that the different breeds of the modern domestic horse have been developed out of the interbreeding of several original wild species; this, however, is only conjecture. What is known is that domestic breeds have existed in Europe from prehistoric times, and also that they have been improved continually by blending with Oriental horses.

Arabian horses are divided into three classes, which have been recognized as sub-breeds since the fifteenth century. The genuine Arabian is found in the region from Damascus to the Euphrates, as well as in Arabia proper. The breed is found in its greatest purity and excellence in the stables of the Sultan of Turkey. The Turk, or Turkish horse, found in portions of European Turkey, but principally in Asia Minor, was of considerable importance in the seventeenth century, but it has deteriorated very much since then. The Barb is a native of the Barbary States, whence its name. It is found in greater perfection among the Moors, who introduced the Barb blood into Spain during their rule in that country, and so improved the Spanish horse that for several centuries it occupied the first place throughout Europe. Spanish horses of this stock brought to America by the Spaniards are regarded as the progenitors of the mustangs and the other wild breeds common to Mexico and California. (See heading, *The Horse in America*.) About the middle of the sixteenth century Italian and Spanish horses (the former heavy types, and the latter, owing to their Barb blood, very much lighter and fleeter) were in the greatest demand. It is during this period that horsemanship (q.v.) began to be studied as a science, the first book concerning which was published by Grisoni in Italy in 1552. The Italians were also the first to take up the teaching of horsemanship as an accomplishment, after which riding came into vogue throughout Western Europe. The English thoroughbred is spread over a larger portion of the earth to-day than is that of any other breed, and the literature bearing upon it equals that of all the other animals combined. It is used more than any other to improve the blood of horses of general utility throughout the world, and, according to statistics, more capital is influenced by it than by any other two or three breeds combined.

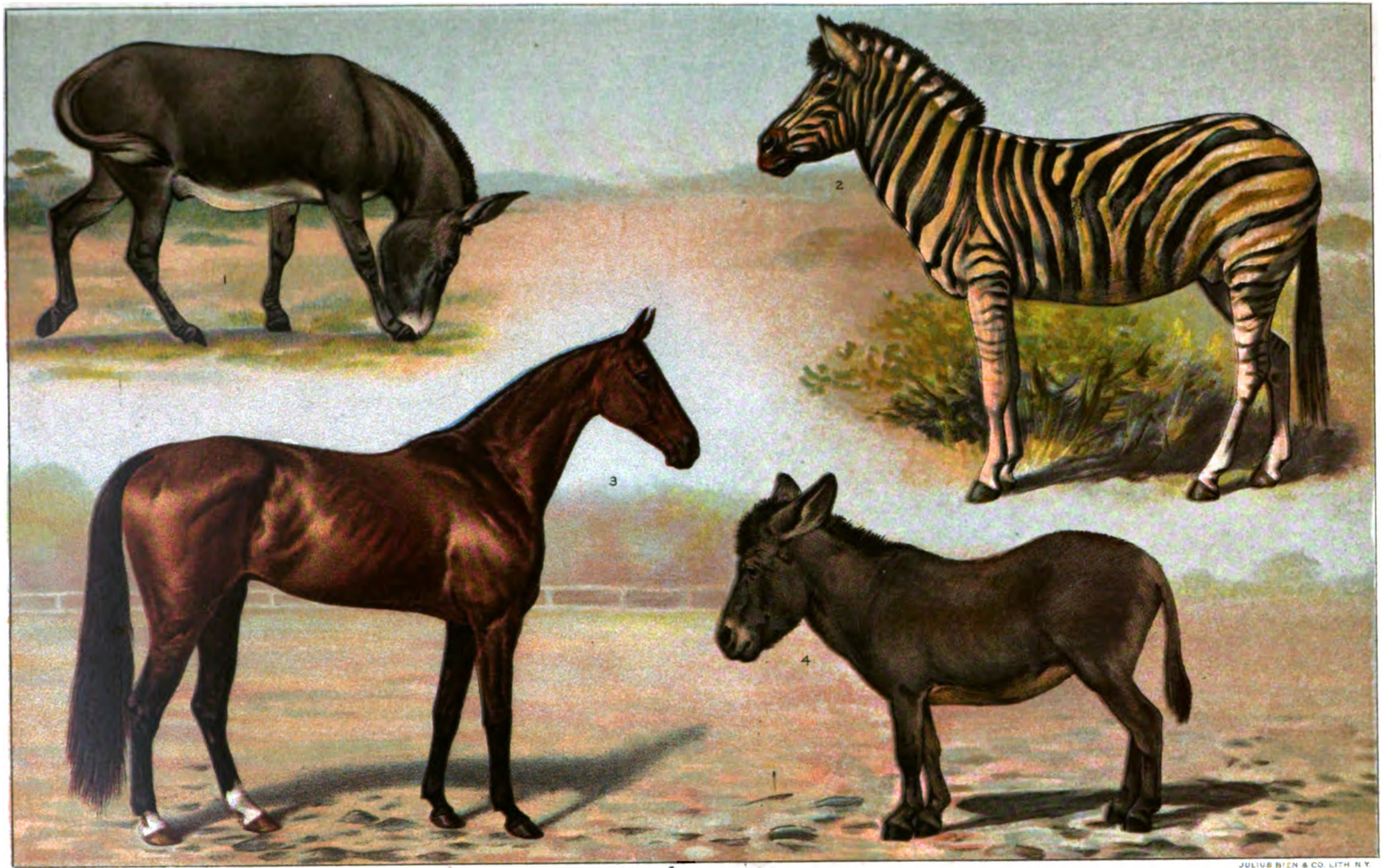
The history of English horse-breeding has been divided into three periods: the first extending from the earliest records to the end of the sixteenth century; the second from the accession of James I. to the first year of the *Stud Book* (q.v.), 1791 (in which period the thoroughbred came into existence); and the third period extending to the present time, in which the thoroughbred has become a clearly defined as well as a pure breed. The original British horse was a small pony, shaggy and hardy, and rarely more than 14 hands high, but the importation of stallions from Spain, Italy, and France improved the breed from time to time. During the Crusades and the consequent general use of heavy armor, which continued up to about the year 1600, large horses came into vogue. A knight in armor, together with his horse-accoutrements, weighed from 350 to 425 pounds, so that during the age of chivalry all breeding was directed toward improvements in the size of the horse. Stallions under a certain size were condemned by law, and in 1217 one hundred stallions were imported from Normandy, and for nearly five hundred years subsequently size was sought for rather than speed; thus laying the foundation of the different modern breeds of British draught-horses. What was the case in England was equally so with the nations of Western Europe and their horses; so that the horse of this period is particularly remarkable for its broad chest, heavy neck, and round buttocks. With the appearance of gunpowder and firearms, and the disappearance of armor, these breeds became useless for the purpose of warfare, which now demanded fleetness as a first essential. They passed, however, to a greater sphere of usefulness, and to-day constitute the heavy draught breeds known as the Dutch and Flemish, the Percherons (q.v.) of France, the Clydesdale of Scotland, and the cart and shire horse of England (see SHIRE HORSE).

Before the days of the tournaments in England large horses were scarcely known, but the needs of the knights compelled the keeping of a sufficient number, so that by intermixture with smaller native animals the size of the British horse gradually increased; but the result proved that, although they were bigger, they did not nearly possess the qualities of the smaller horse. During the Crusades the excellence of the Saracen horses deeply impressed the British Crusaders, who brought many Asiatic horses with them on their return to England. The Eastern horses were Barbs, Turks, Arabs, and Persians, not more than 14½ hands high, and it is to them that the English horse owes in part its present conspicuous qualities. Laws were passed to promote the breeding of large horses by improving the type of British ponies. During the reign of Henry VIII. it was ordained by law that no stallion less than 15 hands and no mare less than 13 hands should run wild in the country. Colts two years of age and under 11½ hands high were not permitted to run on any moors, forests, or commons where mares were pastured, and to guard against any mishaps it was further ordered that at Michaelmastide the magistrates of the neighborhood were to search the countryside, the forests, and the commons, for the purpose of destroying all stallions under the required height, as well as "all unlikely tits, whether mares or foals." Prelates and nobles, and every one whose wife wore a velvet bonnet, were compelled to do their "leaping and riding upon stallions not less than 15 hands high." There were two classes of horses throughout the country; the first a "very indifferent, strong, slow, heavy draught-horse," and the second "light and weak." Private matches were often arranged, showing that speed was becoming a greater factor than size and weight.

Although there had been public horse-racing in Elizabeth's time, it was not until James I. ascended the throne that horse-racing was legally established. He introduced into England the Markham Arab, which was known to be a pure-bred animal, and in many other ways did much to improve the breed of horses. A distinction was drawn between race-horses and common horses; the race-horses were trained for their competitions, and 140 pounds was the average weight of a professional jockey. During the reign of Charles I. a memorial was presented to the King bewailing the gradual disappearance of stout horses fit for the defense of the country, by stating that the breed of strong horses was likely to disappear unless measures were taken for their propagation. The tournament was no more, the pack-horse had practically disappeared, the introduction of the coach had removed a large part of the pack from the horse's back, and everything was done to encourage cross-breeding with foreign importations. From such ancestors the modern thoroughbred has descended. After the civil wars and during the reign of Charles II. the race-courses at Newmarket and at Datchet Mead, near Windsor, were laid out, and the King himself became the first great supporter of the turf. The most conspicuous English horseman of this time was the Duke of Newcastle, who in 1667 published his celebrated work on horsemanship, the reading of which is said to have so interested Charles that he became the largest individual importer of foreign blood in the country. The Stuart kings maintained magnificent studs and constantly employed purchasing agents to secure the best Oriental blood; but, unfortunately, the pedigree of many of these animals is largely a matter of tradition, owing to the fact that the *Stud Book* had not been issued. In spite of the infusion of foreign blood, however, the English race-horse in the time of the Stuarts was a clumsy-looking animal in comparison with the pure Oriental type, or with the race-horse of to-day. He was strong and of large build, but neither as elegant nor as swift on the race-course as was the Barb. The combination of native English stock and such horses as the Helmsley Turk, Byerly Turk, Pace's White Turk, D'Arcy's White Turk, Selaby Turk, and by such Barbary stallions as Dodsworth, Carwen, Bay Barb, Greyhound, Compton Barb, and Toulouse Barb, produced a horse remarkable for its well-proportioned locomotive parts, legs, shoulders, etc., strong carcass and deep chest, the typical animal of speed and endurance.

Since the middle of the eighteenth century the practice of interbreeding with Oriental blood has been discontinued, and although half-bred horses were raced until the first part of the nineteenth century, the thoroughbred has ever since the foundation of the 'racing calendar' been the recognized race-horse, and his pedigree has been strictly and authentically kept. During the seventeenth century speed was not the sole qualification of a race-horse; it was required to have strength and endurance. From racing matured horses at long distances, it was an easy transition to shorten the length of the course and increase the speed of the horse, besides which, the element of gambling entered into the sport, and it soon happened that three-year-old horses were used in the races. It was found, however, that they could not 'stay' the old four-mile course, so that of necessity the distances had to be reduced to accommodate the horses. The result of this policy is seen in modern horse-racing (q.v.), in which two-year-old horses developed for speed

HORSES



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1 WILD ASS - EQUUS ASINUS
2 BURCHELL'S ZEBRA - EQUUS BURCHELLI
3 HORSE (THOROUGHBRED)
4 DOMESTIC DONKEY

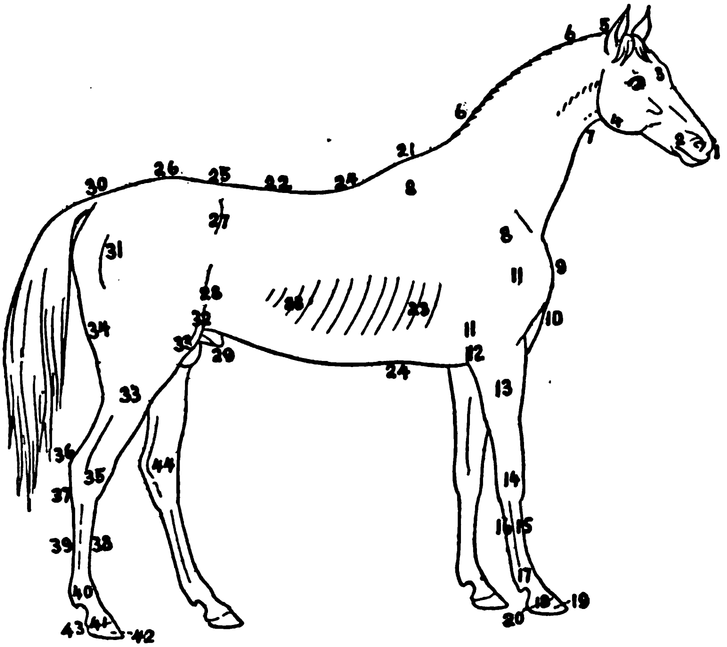
alone take part in races over courses less than half a mile in length.

THE HORSE IN AMERICA. According to paleontology, the horse is indigenous to the American Continent, but it is certain that the American horse of to-day is the descendant of animals brought here by Europeans and the first settlers. Cortés used but few horses in his Mexican conquest, but undoubtedly some of them became progenitors of the American wild horse; and similarly, the horses abandoned by the unfortunate Ferdinand De Soto near the Texas border became the progenitors of all the wild horses of North America. (See HORSE, FOSSIL.) The character and action of the American horse will be found fully described under TROTTING and PACER.

THE COLONIAL PERIOD. The earliest colonists of Virginia were not remarkable for the qualities that make the ideal pioneer, so that it is not surprising to learn that their first supply of domestic animals (including horses) was consumed as food. Although there had been several shipments of horses from London down to about 1640, in 1646 there were only between 200 and 300 horses of both sexes in the colony. In 1656 the exportation of mares was prohibited by law, but in 1667 the restriction was removed. The horses of the period are described as having been of hardy and strong quality, but undersized, and, like the horses in other colonies, they were branded and turned loose to find their own subsistence. Owing to the rapidity of their increase, they were soon very numerous and became practically wild; so much so that at the close of the seventeenth century it was a common as well as profitable sport to hunt wild horses, for an animal without a brand became the property of its captor. On the island of Chintoteague, off the coast of Virginia, there are still in existence bands of wild horses, and only within recent decades has there been any attempt to domesticate any of their number. They are of all colors, and uniform in size, not averaging over 13 hands, and are accounted for in their present location as being the descendants of a band of Virginian wild horses which located there when it was a peninsula, and had their retreat cut off when time converted what had been a peninsula into an island. Notwithstanding occasional efforts to increase its size, the Virginian horse retained the characteristics of its English ancestor.

The settlers of New Netherlands brought their horses from Utrecht. They were larger, better, and more valuable, so far as prices were concerned, than the English horses of the other colonies, but were not regarded as being as good for saddle work. The two breeds soon intermixed, and a larger breed resulted, for at the time of the Revolution the average height was 14 hands and 1 inch. Horse-racing was introduced by Governor Nicholls, of New York, in 1665. He established a race-course on Hempstead Plains, Long Island, which was the first official and properly organized race-course on the Continent. It is supposed that the horses were of the Dutch breeds, because the people attending were largely of that nationality. The English race-horse was not at that time thoroughly developed, and in any case was not imported into New York until nearly one hundred years afterwards. The New England colonies played a very important part in the development of the modern American horse. In 1629 the first horses were imported into New England from the proprietary company in London. In 1635, 27 mares and 3 stallions were shipped from Holland, and sold in Salem; and five years later conditions were such that the colonists were enabled to export a shipment of 80 animals to the Barbados. It has been ascertained from an investigation covering the period 1756-59 that the average height of horses was 14 hands 1 inch, and that three-fourths of the total number were pacers and one-fourth trotters. The founders of Hartford, Conn., brought horses with them (1636), and in 1653 the General Court at New Haven ordered all horses to be branded, and instituted a system of public saddle-horses for hire. The average size was 13 hands and 3 inches. Roger Williams and the settlers of Rhode Island Colony (1636) obtained their horses from Massachusetts, and succeeded so well in the breeding of them that in 1690 horses were their principal export, and they shipped them to all the colonies of the coast. Pacers were raised in Rhode Island, and were widely known as Narragansett pacers. Trade with Canada was not permitted, but there is no reason to doubt that an occasional trade was made, whereby a Narragansett pacer changed owners for the consideration of a bale of peltry, such as only the French Canadian could offer. Racing was especially encouraged in Rhode Island, and thus was developed the speed that made their horses famous. In 1768 the average size of a Narragansett was 14 hands and 1 inch. The horses of Pennsylvania were not handsome, but good. In the early part of the seventeenth century the Pennsylvania horse was the largest and heaviest horse in the country; but one hundred years later they seem to have ranked in both respects below the horses of all the other colonies. Up to 1750 the average size in eastern Pennsylvania was about 13 hands and 1¼ inches. Philadelphia boasted the speediest and finest horses, and pacers were the most fashionable and popular. New Jersey supplied itself from New York and Pennsylvania, and by the beginning of the eighteenth century racing had become so common as to be a nuisance; so much so that in 1748 there was enacted a law for the suppression of 'running, pacing, and trotting races.' The year before the Colony of Maryland, which had in all probability received its supply of horses from Rhode Island, Pennsylvania, and Virginia, passed a similar law. North and South Carolina secured their horses from Virginia. In Canada horses were received from Picardy, France, in 1665, and it is assumed they were largely of the English type. Many of them are supposed to have been pacers; but whether they were, or whether, as is sometimes argued, the Canadian pacer is derived from the illicit trading with Rhode Islanders for their Narragansetts, is a question much discussed.

The American horse was for two hundred years the sole means of travel, and the great essential to all business in and between the various colonies of the country. Improved roads have made him a driving horse, and none of the inventions of modern times, from the introduction of railroads to bicycles and horseless vehicles generally, has affected his popularity or his value. To the superficial observer it would appear as if improved means of vehicular transport would diminish the breeding of horses, as well as decrease their value, but thus far such has not been the ease. Good horses have a higher value than ever, and as the demand for cheap or poorly bred horses diminishes, the better bred ones survive, and what is lost in number is more than balanced in breed and consequent value. (See **Breeds and Breeding.**) The principal breeds of racing horses are the Bashaws, Clays, Black Hawks, Hambletonians, Mambrino Chiefs, Pilots, American Stars and Blue Bulls. (See **Trotting and Pacer.**) The most prominent types of the pony include the Shetland, Galloway, Welsh, Dartmoor, Exmoor, and Canadian breeds. (See **Pony.**) See also the articles **Ass**; **Mule**; **Shire Horse**; **Percheron Horse**, etc.



Head—1, muzzle; 2, nostril; 3, forehead; 4, jaw; 5, poll.
Neck—6, 6, crest; 7, throttle or windpipe.
Fore Quarter—8, 8, shoulder-blade; 9, point of shoulder; 10, bosom or breast; 11, true arm; 12, elbow; 13, fore-arm (arm); 14, knee; 15, cannon-bone; 16, back sinew; 17, fetlock or pastern joint; 18, coronet; 19, hoof or foot; 20, heel.
Body or Middle Pieces—21, withers; 22, back; 23, 23, ribs (together forming the barrel or chest); 24, 24, circumference of chest—called the girth; 25, the loins; 26, the croup; 27, the hip; 28, the flank; 29, the sheath; 30, the root of the dock or tail.
Hind Quarter—31, hip-joint or whirl-bone; 32, stifle-joint; 33, lower-thigh or gaskin; 34, the quarters; 35, the hock; 36, point of the hock; 37, the curb place; 38, the cannon-bone; 39, the back sinew; 40, pastern or fetlock joint; 41, coronet; 42, foot or hoof; 43, heel; 44, spavin-place.

The *hackney* is bred chiefly for carriage purposes, and is a type indigenous to the eastern counties of England. It is of excellent symmetry of proportion, and is capable of a very true rhythm in action; although it is slower and heavier than the roadster, it is faster and much lighter than the middle-weight draught-horse. A well-bred hackney should be properly balanced in fore and hind quarters and middle piece. Since 1890 there have been large importations of this breed to America, although the hackney has been known here by occasional single importations since 1822. It has been especially valuable in the breeding and development of the American trotter. The *cob* is a native of Norfolk and Lincolnshire, in England, and is a stoutly built, short-legged animal of from 13.3 to 14.3 hands high. It is smaller than the hack and larger than the pony. The *Galloway* is a horse common to Wales and North Britain. It seldom ranges above 14 or 14½ hands in height, and is not a particularly valuable animal. Specimens below 13 hands are called ponies. The *hunter* is not required to be a thoroughbred animal, although where the hunting warrants it he is frequently thoroughbred, or half-bred at least. He is chosen to suit the country over which he is hunted, as well as to carry the weight of his rider. In any case he should have the following characteristics: A lean head and neck, firmly set on good oblique shoulders; a strong back and loin, deep body, wide hips, good quarters, and firm legs and feet. Among horsemen the following terms are in use: A *stallion* is a male horse, and when gelded is termed a *gelding*. A *mare* is the female. Animals of both sexes when young are termed *foals*; the male foal is a *colt*, and the female a *filly*. Young animals become 'of age' when the outer incisors (corner nippers) are developed. A horse is '*aged*' when in its eighth or ninth year, a fact determined by the front teeth. The period of gestation is eleven months, the foal usually being dropped in the spring.

Exterior Parts of the Horse. Many excellent works on the anatomy of the horse are published, several of which will be found included in the bibliography of this article. Below will be found described the more important external parts, together with their position and boundaries. *The Head.*—The point of demarkation between the head and the neck may be described as follows: Observing the animal in profile, the head is divided from the neck by an imaginary line drawn from the back of the ear, along the rear edge of the lower jaw to its angle. The upper part of the face is called the forehead, and the forelock is a tuft of hair which, although a part of the mane, lies between the ears. The temples lie on each side of the forehead, between the ear and the eye; the nose is a continuation of the forehead, ending opposite the nostrils. The lower end of the head is called the muzzle; it includes the nostrils, lips, and the bones and teeth covered by them. The bars of the mouth are those portions of the gums of the lower jaw situated between the back teeth and the tushes (or the place usually occupied by the tushes). Just under the bars of the mouth is the chin-groove, in which rests the curb chain of the curb bit, when such is used. The neck lies between the head and the shoulders, from which latter it is separated by an imaginary line drawn from the dip in front of the withers to the depression caused by the union of the neck and breast. On the top of the neck, and immediately behind the ears, is the poll; and extending from the withers to the ears, along the upper part of the neck, is the crest. The groove on each side of the neck just above the windpipe is known as the *jugular groove*. The *chest* is divided from the belly or abdomen by the diaphragm, and includes the cavity in which are situated the lungs and heart, and which occupies nearly the front third of the trunk. The term *breast* is frequently used to describe the part herein treated under chest. The upper boundary of the shoulders is formed by the withers, and the rear border may be taken from behind the 'swell' of the muscle, situated just below the withers to the elbow. A little below the junction of the neck and shoulder, on each side of the chest, is a prominent bony angle, known as the point of the shoulder. The withers are the bony ridges which constitute the forward continuation of the back and end abruptly in the crest. The elbow is the bony projection at the upper posterior part of the forearm, which latter is found between the shoulder and the knee. The upper boundary of the knee may be decided by a line drawn at right angles to the direction of the leg above the knee-joint, and the lower boundary by a line joining the point where the line of the cannon-bone meets that of the knee, with that where the line of the back tendon is terminated by the trapezium, at the back of the knee. The cannon-bone is situated between the knee and the fetlock. At its back are two small bones, known as the outside and inside splint-bones. The cannon is the very confusing name applied to that part of the leg situated between the knee and the fetlock (i.e. footlock, a tuft of hair growing behind the fetlock joint). The joint which the cannon-bone makes with the pastern is called the fetlock joint. Between the fetlock and the hoof is a short column of bones called the pastern, the lower portion of which, called the coronet, is immediately above the hoof. The hoof is a horny box inclosing the lower part of the limb. The lowest front part of the hoof is the toe; the sides are quarters; and the lowest rear part the heels. The exterior or outer part of the hoof is termed the wall, which in turn is divided into an outer covering or crust, and a soft inner layer of non-fibrous horn. In the centre of the ground surface of the hoof is a triangular buffer called the frog, in the middle of which is a division termed the cleft of the frog; turned inward at the heels, and running more or less parallel to the sides of the frog, are the portions of the wall called the bars of the hoof. The ground surface of the foot between the wall, bars, and frog, is called the sole. The back includes the withers, but not the loins; which parts, together with the ribs on each side, constitute the boundaries of what may properly be termed the back. It has been described as an ill-defined region, owing to the many different opinions on the subject. The loins are found between the back and croup, with the flanks on each side. The ribs lie between the shoulders, flanks, belly, and brisket or sternum. The flank is that part of the horse's side between the loins, ribs, thigh and hip-joint, and the belly. The hollow of the flank is the upper portion of the flank. The belly is the cavity which contains the stomach, liver, spleen, intestines, kidneys, bladder, etc. The brisket is the lower part of the chest. The croup is that portion of the upper part of the body placed between the loins and the tail. Broadly stated, it extends down on each side to the point of the buttock. The thigh has been cleverly defined as separated from the stifle, flank, croup, buttock, and gaskin by a horizontal line drawn from the upper end of a straight line made by the hamstring, which proceeds toward the thigh from the point of the back. While not anatomically correct, it is the general acceptation of the term. The gaskin lies between the thigh and the back, which latter is found between the gaskin and the hind cannon-bone. The dock is the solid part of the tail.

INDICATIONS OF AGE. It is very difficult, if not impossible, to formulate any rules by which the age of a horse may be accurately determined. To an expert horseman the lightness and elasticity of step of the animal under examination will afford a general clew; or better still, the contour of the lower jaw, which grows more and more angular with increasing age. It is to some structure of the animal little liable to change, however, that we must look for any very accurate gauge, and the only structure answering that requirement is that of the teeth, which must be examined according to the following rules: The six teeth or nippers, situated in the front of the lower jaw, are the ones examined to determine the question, although the tushes are a partial indication, and are sometimes used in arriving at a decision. In this article, the two middle nippers will be referred to as the central nippers; the ones on each side of these, as the middle nippers, and the ones at each end of the group as the corner nippers. At two and a half years of age, the permanent central nippers are just through the gum, the temporary middle and corner nippers still remaining; one year later the permanent middle nippers are in evidence, and between the fourth and fifth year the corner nippers will be through. About this time changes will be noticed in the condition of the earlier teeth; for instance, the middle pair look as the central pair did at two and one-half years, and the central nippers are showing signs of wear. Between the ages of five and nine, considerably more experience is necessary for an accurate judgment than has been required before. At nine years of age the previous oval shape of the teeth becomes more triangular; at ten the central nippers take a pronounced triangular shape, and the middle pair give evidence of a like tendency, followed at eleven years by the growth of the corner nippers in the same direction. The tushes become rounded at the points, and the nippers are longer and project more, the central nippers being completely triangular. The signs of wear and tear, and the growth of the evidences already described, continue with increasing age, so that at twenty years the nippers are all exceedingly triangular, projecting forward to a great degree, and are very long.

The character or temperament of a horse cannot be discerned short of actual experience, by any known formula or given rules; for while the experienced horseman may judge approximately by noting the shape of the face and head, and the expression of the eyes, he will, as a rule, be unable to explain the method or rules upon which his conclusions are based. Like men, horses are of different dispositions, and exhibit such varied characteristics as pride, dignity, intelligence, stupidity, courage, cowardice, etc. Generally stated, an intelligent horse shows considerable width between the eyes, which latter are very prominent. The width between the ears is taken to indicate courage and strength of character; and roundness and elevation between the eyes, as denoting a mildness of disposition. A timid horse is usually narrow between the ears, and a stupid one, narrow between the eyes.

DISEASES OF THE HORSE. No other domestic animal is so large a sharer with humanity in the accidents and dangers incident to modern civilized life as the horse. It is practically a copartner with man in every detail of his life and work, and yet no other animal suffers so much from ignorance, abuse, maltreatment, and quackery. Modern civilization is doing much to alleviate the condition of the less fortunate of his kind, notably the various societies for the prevention of cruelty to animals. (See CRUELTY TO ANIMALS, PREVENTION OF.) The practice of veterinary surgery has become one of the most exacting and advanced of professions, and diseases long considered incurable are now amenable to treatment. In European countries the horse is an object of governmental solicitude, as much for his value as a factor in warfare as for purely humanitarian reasons; and a careful census record is kept (particularly in Germany) of the number, pedigree, and value of the horses throughout each country. The Government of the United States, through its Department of Agriculture, alone of all the nations of the world has compiled a special *Report on the Diseases of the Horse*, which is published as a guide and aid in the cultivation of a proper knowledge of the care and treatment of the animal. Below are described some of the more prevalent diseases, which will be found more fully treated in the above-named publication.

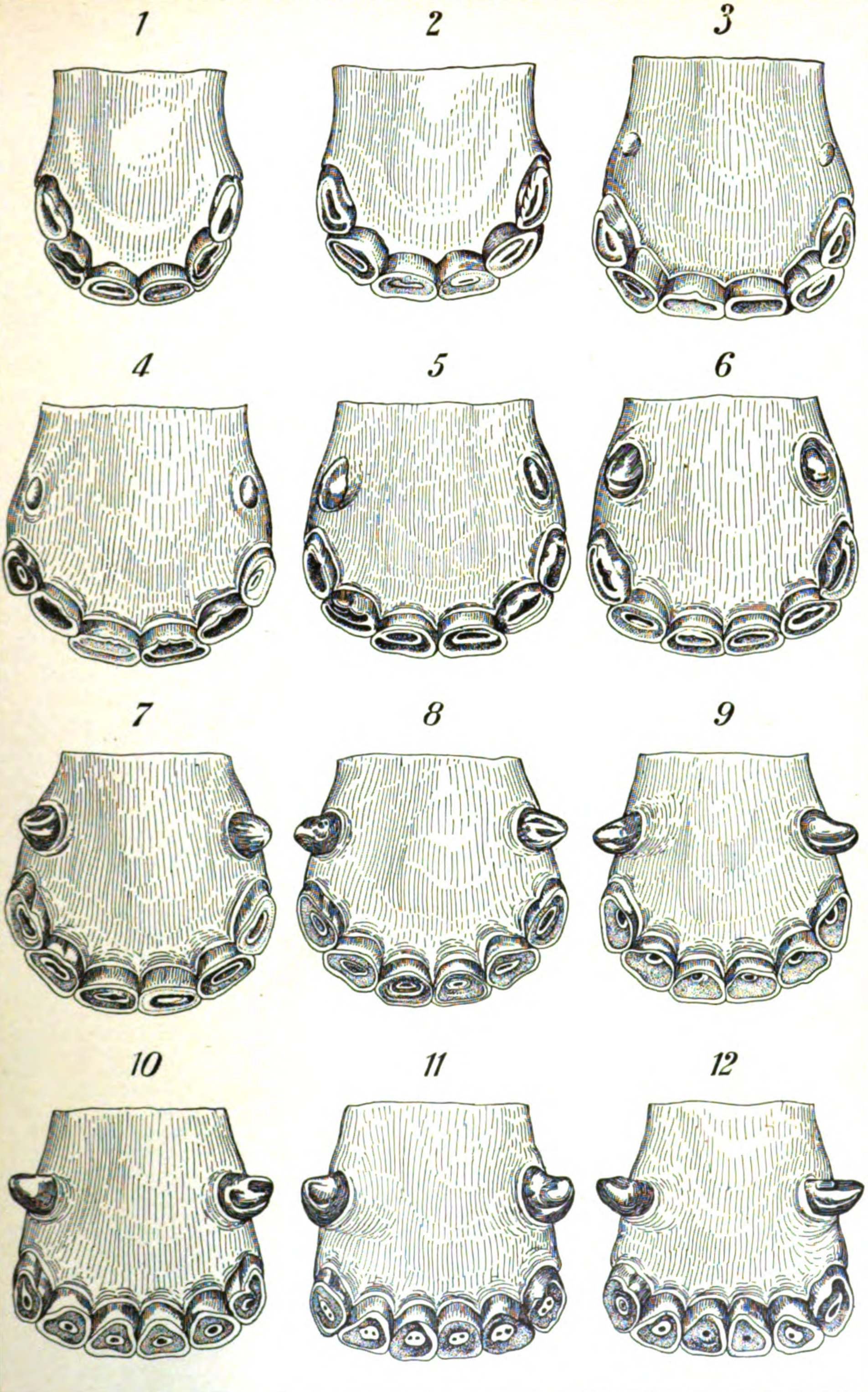
THE TEETH. Dentition covers the period during which the young horse is cutting his teeth, usually from birth up to the age of five years. As a rule the horse has more difficulty in cutting the second or permanent teeth than he has with his first or milk teeth. With regard to the latter the mouths of young horses should be frequently examined in order that the milk-teeth may not remain too long and thus cause the permanent teeth to grow in crookedly. Toothache is rare with the average horse, and then only where a tooth is allowed to decay. Usually it is only observed in the molar teeth, and may be discovered by the evidences of pain given by the horse when feeding or drinking cold water.

DISEASES OF THE MOUTH. (1) Lampas (q.v.): A swelling of the mucous membrane of the hard palate, projecting in a more or less noticeable ridge immediately behind the upper incisors. (2) Stomatitis: An inflammation of the mucous membrane of the mouth, generally produced by irritating medicines, foods, or other substances such as often follows in the case of city horses from eating out of ash-barrels. (3) Glossitis: An inflammation of the tongue very similar to stomatitis, both in origin and in symptoms. (4) Ptyalism, or salivation, is an abnormal and excessive secretion of saliva, often caused by irregular teeth, inflammation of the mouth or tongue, or the use of medicines, and occasionally by the eating of second-crop clover. (5) Pharyngitis (q.v.): An inflammation of the mucous membrane lining of the back part of the mouth, or pharynx. (6) Paralysis of the pharynx, or as it is more generally called, paralysis of the throat, is a disease first discovered from the fact that the animal is unable to eat, and the manger is found to contain much saliva and frothy food that has been returned through the nose.

DISEASES OF THE ŒSOPHAGUS OR GULLET. It will be found in the vast majority of instances exhibiting these diseases that the cause is the introduction into the organ of foreign bodies too large to pass, or else that there are present erosions and ulcerations of the throat (followed by constriction or narrowing of the gullet) caused by the administration of caustic medicines not thoroughly diluted. The designations pharyngeal, cervical, and thoracic choke are used to denote where the obstruction is located, the symptoms varying according to the position of the agent responsible for the choke.

DISEASES OF THE STOMACH. (1) Stomach staggers (see STAGGERS), or gorged stomach (*Impaction*): Distention of the stomach caused by food, in which the stomach loses the power of contracting upon its contents. (2) Tympanites of the stomach: A disease corresponding to that of 'hoven' or 'blown' in cattle, and frequently due to the overloading of the stomach with young, succulent herbage, which, after its arrival in the stomach, liberates quantities of fermentation gas sufficient to distend the stomach seriously. Overfeeding is a very frequent cause of stomach-bloat, particularly if the overfeeding is followed immediately by hard work. The symptoms are very much the same as for stomach staggers, and the treatment must be at once vigorous and immediate. As a rule, cases of this trouble occur away from the stable. From two to four ounces of common baking-soda should be given as quickly as possible, an additional half-ounce of cayenne pepper being given to aid the stomach to contract and expel the gas. Charcoal may be given in any amount, and any medicine that will check fermentation or absorb the gases will be found useful. Cold water dashed with force over the stomach is frequently an aid. (3) Rupture of the stomach: If convinced that the diagnosis is correct it is better to destroy the animal at once. If, however, there is a possibility of mistake, powdered opium in one-dram doses may be given every two or three hours, thus keeping the stomach as quiet as possible. The case should be kept under the observation of a skilled veterinary. (4) Bots: There are so many opinions extant concerning this disease, many of which are erroneous, that it will repay any owner of stock to make a careful study of it. With regard to the insect itself, see BOT and GADFLY. Of the numerous insect parasites on solipeds, the gad-flies (Œstridæ) are the most important. The species responsible for the above-named disease infest chiefly the stomach and duodenum—a small gut leading from the stomach. Nearly all country horses, as well as those experiencing their first year in the city, have the bots, but the common opinion that bots frequently cause colic pains is erroneous. If in large enough numbers they may sadly interfere with digestion. The animal may not thrive and emaciation may follow, but beyond this they are harmless. It is fortunate that such is the case, for there are no medicines that affect them: neither acids, alkalies, nor anodynes are capable of securing

HORSE



AGE-MARKS ON THE TEETH OF THE HORSE

1. One Year Old.
2. Two Years Old.
3. Three Years Old.
4. Four Years Old.
5. Five Years Old.
6. Six Years Old.
7. Seven Years Old.
8. Nine Years Old.
9. Eleven Years Old.
10. Thirteen Years Old.
11. Fifteen Years Old.
12. Seventeen Years Old.

their ejection from the stomach. The best that can be done is to watch for their eggs on the legs and body of the horse during the late summer and autumn, and carefully scrape them off and burn them. (5) *Indigestion:* Indigestion is imperfectly performed digestion, which in the horse causes symptoms closely resembling those of dyspepsia in man. A great cause of indigestion with the horse is found in the food itself. (See section on *Care of the Horse.*) The teeth are in many instances to blame, their sharp, irregular, or decayed condition preventing any perfect mastication, and causing the animal to swallow his food before it receives the requisite admixture of saliva. The principal seat of indigestion is in the stomach or small intestine. It is characterized by an irregular appetite, refusal of food or gorging, and a disposition to eat unusual substances, as wood, salt, bedding, and frequently his own fæces. The animal loses flesh, and the skin becomes hard and dry and hide-bound. The treatment usually consists of a careful regulation of food as regards quality, quantity, and time of feeding, and an exercise of similar care as regards the water-supply. The condition of the mouth and teeth must also be attended to, and the teeth if sharp or irregular must be rasped down, or extracted if decayed. If the indigestion is caused by ravenous eating, the animal should be fed from a manger sufficiently wide to allow the spreading of the grain, which will usually compel the horse to eat slowly. Frequently a cathartic is given at the outset.

INTESTINAL WORMS. Worms are very frequently found in young horses, as well as in those that are weak or debilitated. They almost invariably exist in horses pastured on low, wet, or marshy ground, as well as in those that drink stagnant water. The most common form of intestinal worm is the lumbricoid worm, which closely resembles the common earthworm. It is white or reddish in color, measuring from four to twelve inches in length, and varying in thickness from the size of a rye straw to that of a cigar, being thickest at the middle and tapering toward each end. At first, slight colicky pains are noticed, or a vigorous switching of the tail, and frequent passages of manure; the animal does not shed its coat, and is hide-bound and pot-bellied. He will be particularly fond of salt, and will bite at the woodwork of his stall; the bowels are irregular, either constipation or diarrhœa being present. Among the best medicines for worms are santonin, turpentine, tartar emetic, infusion of tobacco, and bitter tonics. Whatever remedy is given, it will be found much more effective if administered after a long fast, and then the worm medicine must be supplemented by physic to force out the worms. There are many varieties of worms, the treatment for which is usually along the lines above described.

SPASMODIC OR CRAMP COLIC is the name given to colic which is produced by contraction or spasm of a portion of the small intestines. It is usually caused by indigestible food; foreign bodies; excessive drinking of cold water when overheated; draughts of cold air, etc. To insure correct treatment, it is very necessary to keep in mind the type of horse, the force of the attack, the intervals of ease or violent pain, the temperature and pulse, and a frequent attempt to urinate, which will prevent the confounding of this with any other form of colic. The treatment indicated is any antispasmodic medicine, of which probably there is none better than chloral hydrate given in a dose of one ounce in a half-pint of water as a drench. *Flatulent colic, tympanites, wind colic, bloat,* are common among animals subject to sudden changes of food, careless feeding or treatment; too much green food, or any other food that has become stale and sour.

Herniæ: There are several kinds of herniæ, not all of which, however, are to be regarded as serious or dangerous. Abdominal herniæ, or ruptures, are divided into reducible, irreducible, and strangulated, according to their condition; and into inguinal, scrotal, ventral, umbilical, and diaphragmatic, according to their situation. In many instances treatment is not necessary; or, where the hernial sac is extensive, treatment is ineffective. A good deal will depend on whether any one is present when the hernia happens, as to the possibilities of a perfect cure. Umbilical hernia, or diaphragmatic hernia, calls for the most skilled treatment, and even then little or nothing can be done.

ACUTE INFLAMMATION OF THE KIDNEYS. The causes of this disease are many and varied. Congestion occurs from retained products passed through the kidneys during recovery from inflammation of other parts, or fevers. Detained urine, and the possible production of ammonia and other irritants, are also frequent causes. The symptoms consist of fever, stiffness of the back, straddling gait, difficulty in lying down, rising, or walking in a circle. The recognized treatment is as follows: Removal of any cause that can be discovered; then, if suffering from high fever, the removal of from two to four quarts of blood, which should be followed as much as possible by throwing the work of the kidneys on the bowels and skin. *Catarrh,* or *Cold in the Head:* A fluid discharge from the mucous membrane. Inflammation, as a rule, extends to the membrane of the sinuses of the head, and of the larynx and pharynx, causing the added complication of sore throat. Frequently the eyes are also affected. At the first stage of the attack the membrane is dry and irritable, followed by a watery discharge from the nostrils. Fever, more or less, makes its appearance, which is usually detected by placing a finger in the animal's mouth. In itself the disease is not very serious, but if neglected, or treated wrongly, may become complicated and dangerous. A few days of cessation from work, together with pure air and good food, is regarded as the best treatment. *Roaring* (q.v.): A chronic disease, evidenced by a loud, unnatural noise in breathing, and caused by an obstruction to the free passage of the air in some part of the respiratory tract. External causes are nasal polypi, thickening of the membrane, the pharyngeal polypi; deformed bones; paralysis of the wing of the nostril; and more than anything else, paralysis of the muscles of the larynx.

Grunting: A horse is usually first tested by veterinarians for grunting, when if the fault is discovered he will be further tested for roaring. Grunting is a sound emitted during exhalation, when the animal is suddenly moved or struck at.

High Blowing is distinctly a nasal sound, but it must not be confounded with roaring; it is a habit, and does not constitute unsoundness. In the same class should be placed whistling and thick wind. *Bronchitis,* or *Inflammation of the Bronchial Tubes:* While the causes of this disease are of the same order as for other diseases of the respiratory organs, some special causes are the inhalation of irritating gas or smoke, and fluids or solids gaining access to the parts. It is also occasionally associated with influenza, or fever, and frequently supervenes a common cold or sore throat. The animal appears dull, the appetite is partially or wholly lost, the head hangs, and the cough, at first light, is succeeded by a high rasping cough. He prefers to stand with his head to a door or window to secure fresh air, and persists in standing. He has more or less thirst, and frequently the mouth will be found full of saliva. The first step in the treatment of the disease is to secure a pure atmosphere and comfortable quarters whenever possible; a well-ventilated box-stall will be found the best. The body should be covered with a blanket according to the season of the year; the legs should be hand-rubbed until they are warm, then flannel bandages applied to the knees and hocks. If the legs cannot be made warm after hand-rubbing, take any liniment used for sore throat and thoroughly rub in, after which the legs should be covered with bandages. It will be well to rub the same liniment over the chest, the elbow, and shoulder-blade; and from the elbow below, to within about six inches of the ridge of the backbone above. *Pleuropneumonia* (q.v.), may attack both lungs, but as a rule one lung only is affected.

Diseases of the Eye. It is impossible to overestimate the value of sound eyes in a horse, for not only does disease or injury depreciate the selling price of the animal, but it is a great source of danger at all times. Some diseases, like recurring inflammation or moon-blindness, as it is called, are congenital. The structure of the eye is that of a spheroidal body, flattened behind. The posterior four-fifths is inclosed by an opaque, strong, fibrous membrane, which has on its inner side a more delicate membrane consisting principally of blood-vessels and pigment-cells, which in its turn is lined by the extremely delicate and sensitive expansion of the retina. The anterior fifth of the globe of the eye bulges forward from what would have been the direct line of the sclerotic, forming a segment of a much smaller sphere than is inclosed by the sclerotic. There are four straight muscles of the eye, and two oblique and one retractor, enabling the eye to turn inward, outward, upward, and downward, and when all act together the eyeball is drawn deeply into its socket. One of the most common diseases is inflammation of the eyelids, which is caused usually by exposure, bites, or stings of insects, pricks with thorns, or by a whip or club, or as a result of infecting inoculations. All the known causes may ordinarily be divided under the following heads: (a) Inflammations due to constitutional causes; (b) those due to direct injury, mechanical or chemical; and (c) those due to inoculation with infecting material. The local treatments ordinarily advised consist of astringent, soothing lotions (sugar of lead, 30 grains; laudanum, 2 teaspoonfuls; rain-water —boiled and cooled—one pint) applied with a soft cloth kept wet with the lotion and hung over the eye by tying it to the headstall of the bridle on the two sides. The horse should be fed from a high manger, so as to help the return of the blood from the head; and his diet should be laxative and non-stimulating. For a stye or boil of the eyelid, the practice is to apply a poultice of camomile flowers, with the addition of a few drops of carbolic acid. The poultice should be applied in a very thin muslin bag. Wounds such as torn eyelids, caused by the horns of cattle, or perhaps by teeth, or by nails, or the barbs of wire fences, are also frequent. In such cases the edges should be brought together as promptly as possible, so as to secure union without any unsightly distortions. It is an operation that requires experience and skill.

Lameness. By this is meant any irregularities or derangements of the functions of locomotion. There are innumerable forms of lameness, the sources of many of which are so obscure as to defy location until the resulting disease has gained sufficient headway to be serious. In veterinary nomenclature each two of the legs, as referred to in pairs, are denominated a biped, the two fore legs being the anterior biped, and the two hinder the posterior; the two on one side are designated the lateral; and either the front or the hind biped, with the opposite leg of the hind or the front biped, forms the diagonal biped. In health, each biped as well as each individual leg has to perform an equal and uniform duty and carry an equal share of the total weight of the body, so that the result ought to be a regular, evenly balanced, and smooth displacement of the body. According to the rapidity of the motion of the animal in different gaits, each single leg is required at certain moments to bear the weight which had the moment before rested on its congener; or again the legs of one biped may be required to carry the weight of its opposite biped. Beginning with diseases of the bones as a common source of lameness, the 'splint' (q.v.) will be found to be of the commonest occurrence. Indeed, a horse which does not possess one or more belongs to a very small minority. The splint is a bony enlargement on the cannon-bone, between the knee or hock and the fetlock joint. *Ringbones* (q.v.) usually result from heavy labor before the animal was of sufficient age, and consequently before the bones were sufficiently ossified; or else from bruises, sprains, or other forms of violence. *Spavin* (q.v.), or exostosis of the hock-joint, is a disease of the most serious kind for many reasons, not the least of which is the slowness of its development and the insidiousness of it growth. *Fractures* are of less serious consequence in the horse than in man, but nevertheless they are always a matter of grave import and demand at once a most skillful treatment. *Wind-galls* (q.v.) is a name given to the dilated bursæ found at the posterior part of the fetlock joint. *Sprains* are diseases of the muscles and tendons. Ordinarily the cause of a sprain may be attributed to a fall or overstrain, and subsequent soreness, swelling, and suspension of functions. Rest is the prime essential, the treatment consisting of local applications, stimulating liniments, counter-irritation, and occasionally firing. Lameness of the shoulder from sprain is the most frequent, and is popularly described as slip of the shoulder. With draught-horses it frequently is caused by the effort necessary to move off a heavily loaded vehicle. In the great majority of cases a rest is all that is necessary to effect a cure. Under the general classification of diseases of the fetlock, ankle, and foot are to be found many of the most common as well as most fatal (so far as the value of the animal is concerned) diseases known to veterinary science. Many horses are predisposed to injuries and diseases because of imperfectly formed feet, in consequence of which they are peculiarly liable to diseases of this character. Flat-footed horses are liable to corns, pumiced sole, bruises of the sole, and kindred troubles, owing to the fact that the soles of their feet have little, if any, convexity. The flat foot has no arch, so that the weight of the animal falls on the entire plantar surface instead of on the wall, which allows of little, if any, elasticity in the sole. In *clubfoot* the feet have the wall set nearly perpendicular, and consequently the heels stand high and the fetlock joint is either thrown forward or knuckled, and the weight of the animal is thrown onto the toes. In *crooked foot* one side of the wall is higher than the other, causing the animal to be pigeon-toed as well as making it 'interfere.' *Interfering* is when one foot in action strikes the opposite leg. *Knuckling* is another fault, which causes stumbling, and while not always an unsoundness in itself, yet frequently leads to fracture of the pastern. It is a partial dislocation of the fetlock joint, and is caused more often by heavy work in hilly districts or fast work on race-tracks or hard roads than anything else. The principal remedy for all faults of conformation will be found in suitable horseshoeing; which subject is discussed at some length under HORSESHOEING. *Sprains of the fetlock* are the consequence of knuckling or any diseases which interfere with proper locomotion, such as, *navicular disease, chronic laminitis, contracted heels, side bones;* or such external causes as a rut or hole in the road, or any accident which causes the animal to fall. For slight injuries cold-water bandages and a few days' rest will be found sufficient. Should there be severe lameness or much swelling, a stream of cold water playing upon the leg will be found very beneficial. On the subsidence of the inflammation a blister should be applied to the joint. When the shoe of the hind foot strikes the heel or quarter of the fore foot the animal is said to *overreach*, a trouble common to trotting and running horses. When the hind foot catches well back on the heel of the fore foot the horse will frequently be thrown on his knees or the shoe torn from the fore foot, an accident known colloquially as *grabbing*. The art of the shoeing smith is demanded, if future injuries are to be avoided. Wounds should be dressed with tincture of aloes, oakum, and a roller bandage; and in any case the animal should never be driven at a very fast gait unless his heels and quarters are protected with quarter-boots. Heavy or draught horses are liable to calk wounds, caused from tramping either on themselves or each other. Good shoeing and the use of boots will be found the best remedy. *Quittors* (q.v.) have been authoritatively divided into four classes: (a) Cutaneous quittor; (b) tendinous quittor; (c) subhorny quittor; and (d) cartilaginous quittor. *Thrush* (q.v.) is more common with draught-horses than any other breed, and is usually caused by a filthy, ill-kept stable. *Corns* are injuries to the living horn of the foot, appearing in that part of the sole which is included in the angle between the bar and the outside wall of the hoof. They are described, according to the character of the conditions which follow the primary injury, as the dry, the moist, and the suppurative. The disease is confined almost exclusively to the fore feet, because of the greater weight which they support, and because the heel of the fore foot in action first strikes the ground and thus receives much more shock or concussion than the heel of the hind foot, in which the toe first makes contact with the ground. Faulty shoeing is the great predisposing cause, or else the presence of small stones or other objects between the sole and shoe. Lameness caused by bruises of the frog is best treated by putting the foot at once in a bath of cold water in order to prevent suppuration, which will frequently be effective if the disease is caught at the beginning. If suppuration, however, has already commenced, the horn of the frog and of the bars and branches of the sole, if necessary, is to be pared thin in order that the foot may be poulticed and all pressure removed. When the lameness has subsided and the exposed part covered by a new layer of horn, the foot may be shod. Punctured wounds of the foot are of everyday occurrence, and when they, as frequently happens, involve the more important organs contained in the hoof, no disease or wound can be more serious. Most frequently a 'picked-up' nail is the cause of trouble, and again the wounds may happen from sharp pieces of rock, glass, wire, etc. The nearer the injury is to the centre of the foot the more possibilities there are of disastrous results. Punctured wounds of the anterior parts of the sole are the more dangerous because of the possibility of injury to the coffin-bone, the most serious wounds being those which puncture the centre of the foot. Sometimes it happens that a nail has penetrated the frog and remained there for several days without causing lameness, the first evidence of an injury betraying itself when the foot is being cleaned. It must be remembered that if the injury is not too deep, suppuration will be established before lameness develops, so that the feet should always be most closely scrutinized. Should the coffin-joint have been penetrated either by the external cause or by the process of suppuration, an acute inflammation of the joint will follow, which will be invariably accompanied by high fever as well as loss of appetite. The treatment recommended in all cases of punctured wounds is the thinning down of the horn near the seat of injury, a free opening created for the escape of suppurated matter, and the foot itself placed in a poultice. Where the injury is not serious, recovery in a few days' time is ordinarily assured; but where serious injuries have been inflicted, the foot should be treated to a cold bath or the stream of cold water described in the treatment for quittor (q.v.). *Contracted heels*, or, as it is more frequently called, hoof-bound, is common among saddle-horses and those kept on hard floors in dry stables. Ordinarily, but one foot is affected at a time, and it affects the fore feet principally. The disease itself is an atrophy or shrinking of the tissues of the foot, which diminishes in particular the diameter of the heels. Another very prevalent cause is faulty shoeing, although it sometimes happens that it results from other diseases of the foot, as, for instance, thrush, side bones, corns, etc. The disease is indicated by a pinched and shrunken frog, high heels, long bars, straight walls, and hoof so dry that it is almost impossible to cut it. The treatment consists first of all of preventive measures. The feet are kept moist and the horn is prevented from drying out by the use of moist sawdust, occasional poultices of boiled turnips, and a free use of greasy hoof ointments to the sole and walls of the feet. Careful shoeing, however, will be found to be one-half of the cure. *Sand-cracks* may happen on any part of the wall, although usually they appear directly in front and are called *toe-cracks*, or on the lateral parts of the walls, and are known as *quarter-cracks* (q.v.). The latter usually affect the fore feet, and the former the hind feet. A sand-crack, which is a solution of continuity or fissure in the horn of the wall of the foot, may be superficial, involving only the outer parts of the wall, or it may be deep, involving the whole thickness of the wall as well as the soft tissues beneath. The disease is most serious when it involves the coronary band; and may be further complicated by hemorrhage, inflammation of the laminæ, suppuration, and gangrene. The predisposing cause of sand-cracks is the relative dryness of the horn, although excessive dryness is not more dangerous than alternate changes from damp to dry. Other predisposing causes are heavy shoes, large nails, and bad shoeing in general, together with such diseases as canker, quittor, and suppurative corns. Very little can be done in the way of prevention, but the suppleness of the horn may be maintained by the use of ointments, damp floor, bedding, etc., as well as by proper shoeing. After the fissure has made its appearance, all efforts should be directed to prevent its growing longer and deeper, the usual method being to arrest all motion in the edges. A very simple appliance for holding the borders of a toe-crack together is the vachette clasp. They are made of stiff steel wire and are strong enough to prevent all motion in the borders of the crack. Where these instruments cannot be obtained a good substitute is to drill a hole through the horn across the fissure, and close the crack by means of a thin nail made of tough iron and neatly clinched at each end.

Care of the Horse. Careless and improper feeding and watering are responsible for most of the digestive disorders with which the horse may be troubled. With the horse, digestion takes place principally in the intestines, and in selecting food for a horse the anatomical arrangement of its digestive organs and the physiological functions they perform should be carefully studied. All food should be wholesome and clean; the animal should be fed regularly, and because of his small stomach, in small quantities, and frequently. A horse should never be fed too soon after a hard day's work. He may be given a small quantity of hay, but one or two hours should elapse before he gets his regular meal. When it is contemplated to change the food, care should be taken to make the change very gradually, and in any case, the quantity of food given must be in a direct proportion to the amount of labor performed. Should the horse stand several days in the stable, his food should be of a more laxative nature. The following foods are considered the best: The best hay for horses is 'timothy,' but care should be taken that it is about one year old, of a greenish color, and possessing a sweet aroma. A horse fed on grain should be allowed from ten to twelve pounds of good hay a day. Straw should not be fed unless cut and mixed with hay and crushed grain. Wheat and rye chaff should never be used. Of the grain foods, oats easily take the precedence. The best oats are one year old, plump, short, hard, bright, and sweet. They are given either whole or crushed. A fair allowance for the average horse is about twelve quarts of good oats a day. Wheat and rye should not be used except in small quantities and mixed with other grains or hay. The bran of wheat is the one most used, although its value is variously estimated. It is always fed with other grains and tends to keep the bowels open. Maize or corn is not suitable as an exclusive food for young horses, owing to its deficiency in salts. Corn on the cob is generally used as food for horses affected with 'lampas.' It is better given ground, and fed in quantities of from one to two quarts at a meal, mixed with crushed oats or bran. Linseed is occasionally fed with other foods to improve the condition of the skin and keep the bowels open. It is of particular service during convalescence. Steamed or boiled roots and potatoes are frequently used as an article of food, but carrots make the best diet, particularly during sickness. Grass is the natural food of the horse, but it is not sufficient to keep it in condition for work. The amount of water required by the horse varies according to the character of his food; but roundly stated, about eight quarts a day will be a fair average. When resting, water should be given three times a day; when at work, more frequently. The very prevalent impression that when a horse is warm he should not be allowed to drink is very erroneous. No matter how warm a horse may be, it is always safe to allow him from six to ten swallows of water. The danger is not in the water, but in the excessive quantity that the animal will take when warm, if not restrained. It should never be given when ice-cold. A water-trough should always be placed in such position that the sun may shine on it during the winter mornings.

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HORSE. A miner's term, applied to any intruded material which is the apparent cause of a sudden interruption in the continuity of a mineral that is being quarried, as when a dike of igneous rock cuts across an ore body. In vein-mining a detached mass of rock or spar which fills the vein is called a horse, while colliers apply the term to the shale which replaces the coal-bed, as well as to such interruptions as seem to have been the channels of small streams, and which were subsequently filled up by the clay that formed the roof of the coal.

HORSE. On shipboard, an iron jackstay or rail used as a traveler's guide or securing bar, usually called a *horse-rail.* Also the old name for a foot-rope on a yard; and the secondary foot-rope at the end of a yard is still called the *Flemish horse.*

HORSE, FOSSIL. Remains of horses, often of extinct species, have been found in the cave-beds, river-gravels, bone-licks, and loess deposits of the Quaternary Period, or 'Age of Man,' in almost all parts of the world. In the more ancient deposits of the Tertiary Period, or 'Age of Mammals,' have been found remains of a series of ancestors of the horse, which illustrate the evolution of this race through this entire geological period, a time probably of some millions of years. Fossil horses of the Age of Man are much like the existing species, and are included for the most part in the same genus (Equus). They have been found in Europe, Asia, Africa, North and South America, but none in Australia or in the Oceanic islands, except in those which, like the British Isles, were joined to the continental mainland during the early part of the Quaternary Period. With these exceptions the animal was of world-wide distribution, and inhabited especially the open grassy plains and high plateaus of the interior of the great continents, at the beginning of the Age of Man. All these races were at first wild.

In the New World they became extinct. When the Spaniards first invaded the two Americas they found no horses, wild or domesticated. The Indians, who had domesticated the llama, the alpaca, and the dog, knew nothing of the horse, and were astonished and terrified at the sight of the strange and unfamiliar animals which the newcomers rode. Yet, when introduced by the white races, the horse ran wild and flourished and increased greatly in the same regions where its native cousins had formerly lived, showing how well the country was suited to their needs. Why the earlier native horses became extinct is a problem not yet solved.

In Central Asia, two wild races, Przewalsky's horse and the Asiatic wild ass, or kiang (q.v.), persist to the present day; others were domesticated by man in the earliest times, and their use in Chaldea and Egypt for draught and riding is depicted in the ancient mural paintings. In Africa the larger species became extinct, but the smaller zebras still survive in the southern part of the continent, and the African wild ass in the northern part (Somaliland).

The wild species of Europe, a small race, short-legged and shaggy-haired, was domesticated by man, for it is represented in rude prehistoric drawings scratched on bone or ivory by men of the Neolithic or Polished-Stone Age.

The domesticated horses now in use are chiefly derived from the Asiatic race, but it is probable that in some breeds there is a considerable strain of this European species or variety, and it is possible also that African races may have been domesticated and to some extent mixed with the Asiatic species. The existing wild horses of North and South America, the broncos and mustangs, are descendants of the animals brought over by the Spaniards; but it is possible that in South America some survivors of the native races still existed at the time of the discovery of the continent, and mixed with the introduced species when it ran wild.

In general, only fragmentary specimens, parts of skulls, bones, or teeth of these extinct horses have been found fossil, so that their characters are very imperfectly known. A number of complete skeletons were found in Texas in 1899, one of which was placed in the American Museum of Natural History, New York. This species, *Equus Scotti*, was of the size of a trotting horse, but in proportions more like a zebra, with deep jaw, short neck and legs, and small feet. Another extinct species, the Hippidium of Argentina and Patagonia, was large-headed, with extremely short and stumpy legs and feet, exaggerating some of the peculiarities of the Shetland pony, although of larger size.

TERTIARY ANCESTORS OF THE HORSE. The history of the evolution of the horse through the Tertiary Period affords the best-known illustration of the doctrine of evolution by means of natural selection (q.v.), and the adaptation of a race of animals to their environment. The ancestry of this family has been traced nearly as far back as the beginning of the Tertiary without a single important break. During this long period of time, estimated at nearly three millions of years, these animals passed through important changes in all parts of the body, but especially in the teeth and in the feet, by which they became adapted more and more perfectly to that particular environment, namely, the open plains of a great plateau region with their scanty stunted herbage, which are the natural habitat of the modern horse.

EQUINE CHARACTERISTICS. The horse (including under his name the asses and zebras, as well as the true horses—see EQUIDÆ) is unique among modern animals in the fact that it walks on the extreme tip of the central digit of the foot, corresponding to the middle finger-nail of man, and that all the remaining toes have completely disappeared. The feet are greatly elongated, so as to equal the other segments of the limbs in length, and to raise the animal much higher above the ground than if he walked, as does a man or a bear, on the sole of the foot. In each foot the first and fifth digits (thumb and little finger) have completely disappeared and left no trace, while of the second and fourth digits only a small slender rudiment exists which represents the metapodial, or bone of the palm, and is called a 'splint.' These two splint-bones lie closely against the cannon-bone, or metapodial of the central digit, and are not indicated on the surface of the foot. The modern horse is therefore one-toed.

The teeth are equally peculiar. There are six grinding teeth in a closely set row on each side of each jaw; the crowns of these are very much elongated, so that they can be pushed up in their sockets as fast as they wear away at the grinding surface. The grinding surface displays a complicated pattern caused by infoldings of the enamel of the tooth, the enamel edges being supported on one side by the dentine of the tooth, on the other by a similar substance called cement, deposited on the outer surface of the unworn enamel before the teeth are extruded from the gums. This arrangement secures at all stages of wear a series of hard enamel ridges projecting a little above the surface of the softer dentine and cement, and makes a remarkably efficient grinder for the hard, dry grasses which are the natural food of the horse (q.v.). In the series of animals which lead up to the modern horse, we can trace every step in the evolution of these marked peculiarities of teeth and feet, from an ancestor so little suggesting the horse that when first found it was named by Richard Owen, the greatest comparative anatomist of his time, Hyracotherium, or 'coney-like beast.' Its relation to the horse was not at all suspected, and was recognized by Huxley and Marsh only when the series of intermediate stages between Hyracotherium and the modern horse was discovered. This first ancestor of the horse line is very much more like the contemporary ancestors of other lines of descent, and indicates how all the modern quadrupeds have diverged from a single type, each becoming adapted to its especial mode of life.

Stages in the Evolution Series. The Hyracotherium (renamed Eohippus) of the Lower Eocene was a small animal, no larger than the domestic cat, with four complete toes on each fore foot, and three on each hind foot. There is reason to believe that the still more ancient ancestors of this and all other mammals had five toes on each foot, and in the Hyracotherium fore foot we find a splint-bone representing the missing first digit or thumb, while in its hind foot there is a splint-bone representing the missing outer or fifth digit, but here no trace is left of the innermost (first) digit. The proportions of the skull, the short neck and arched back, and the limbs of moderate length, were very little horse-like, recalling some modern carnivorous animals, especially the civets. The teeth, short-crowned, covered with low rounded knobs of enamel, suggested those of monkeys and of pigs, but not at all the long-crowned complicated grinders of the horse. Beginning with this small and primitive animal, eleven stages have been recognized from as many successive formations, showing the gradual evolution of the race into its modern form. Each stage is characteristic of its particular geological horizon. Some have been found in several parts of the world, but by far the most complete and best-known series comes from the Tertiary Bad Lands of the Western States. Besides the main line of descent, which has led into the modern horses, asses, and zebras, there were also collateral branches, which have left no descendants. Only the more important stages can be mentioned here.

The successors to the Hyracotherium were the Protorohippus and Orohippus of the Middle Eocene. A complete skeleton of the former animal, from the Wind River Valley, Wyoming, is in the American Museum of Natural History in New York City. It is about the size of the kit-fox, and much like its predecessor, the Hyracotherium, except that the splint representing the fifth digit in the hind foot has disappeared.

In the Upper Eocene the Epihippus occurs, but only fragmentary specimens have been found. These show that the middle toe was becoming more prominent, and the side toes, especially the outer toe of the fore foot, were quite slender. Contemporary with this animal was the very much larger Palæotherium of Europe, related to the horses, but not in the direct line of descent.

In the Oligocene is found Mesohippus, of which several complete skeletons are known. The various species range in size from that of a red fox to a mastiff. There are but three toes in each foot, the outer digit of the fore foot being now reduced to a splint-bone, and no longer appearing as a separate toe. The central toe in both fore and hind feet is much larger, and the side toes, although they still reach the ground, are quite slender, and can support but a small part of the weight of the animal.

The teeth are of the crested or 'lophodont' type, the crests higher and sharper than in the preceding genera. This constitutes the necessary intermediate stage in the conversion of the low, round-knobbed or 'bunodont' crown into the high, sharply crested crown with cement bracing, which characterizes the later horses. See Tooth.

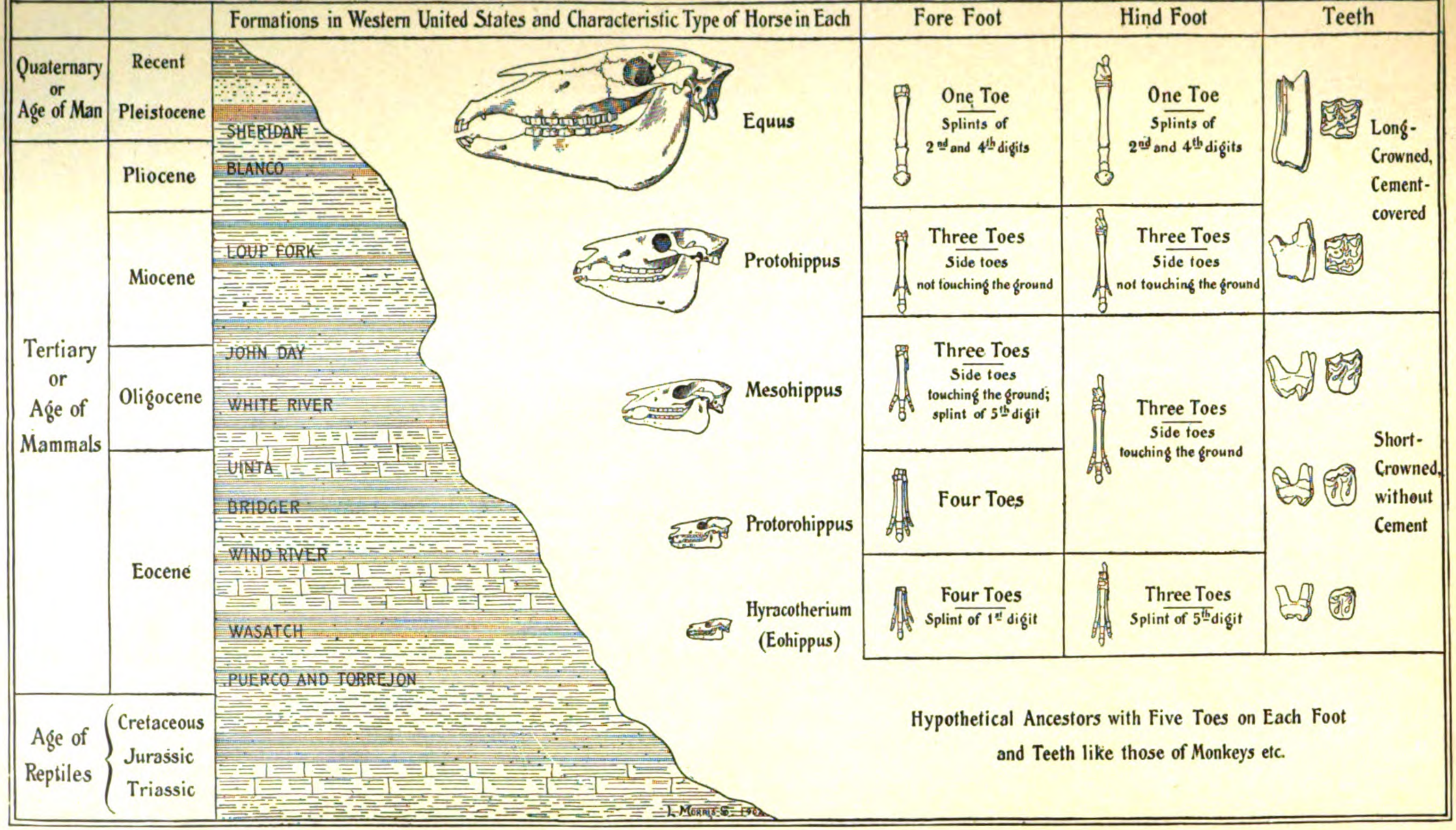
In the Miocene is found Protohippus, in which the side toes, although still complete, are extremely small and slender, and do not reach the ground. They can therefore no longer assist in supporting the weight of the animal, and are merely useless rudiments. Various species range from the size of a mastiff to that of a Shetland pony. The teeth in this animal are much more like those of the modern horse; the crown is greatly lengthened, the crests or ridges being higher and more complicated, and the 'valleys' between the ridges are filled up with a material ('cement') approximating the dentine in texture and hardness. A new and very effective method of grinding is thus begun, for when the sharp enamel crests wear down, they form a double ridge of enamel supported within by dentine and without by cement; the two latter are softer than the enamel and wear away more rapidly, leaving it as a sharp projecting ridge, continually renewed with the wear of the tooth. The tooth is pushed up from the jaw as fast as it wears off on the grinding surface, so that it becomes an efficient grinder for those hard, siliceous grasses which would rapidly wear down a tooth of the old pattern to a useless stump.

In the Pliocene lived the Pliohippus, of which very little is known, except that it was either one-toed or had the side toes reduced to extremely small rudiments, and the teeth were much like those of Protohippus, which it a little exceeded in size.

In the Pleistocene is found the modern genus Equus, of larger size, with but one toe on each foot, the lateral digits represented by splint-bones, and with teeth longer-crowned than those of Protohippus, enabling the animal to grind hard grasses still more efficiently. Extinct species have been found in Europe, Asia, Africa, North and South America, as we have seen above.

Meaning of the Changes in Feet and Teeth. Along with the disappearance of the side toes in the evolution of the horse there is a consider-

THE EVOLUTION OF THE HORSE.



		Formations in Western United States and Characteristic Type of Horse in Each		Fore Foot	Hind Foot	Teeth
Quaternary or Age of Man	Recent Pleistocene	SHERIDAN	Equus	One Toe Splints of 2nd and 4th digits	One Toe Splints of 2nd and 4th digits	Long-Crowned, Cement-covered
Tertiary or Age of Mammals	Pliocene	BLANCO				
	Miocene	LOUP FORK	Protohippus	Three Toes Side toes not touching the ground	Three Toes Side toes not touching the ground	
	Oligocene	JOHN DAY WHITE RIVER	Mesohippus	Three Toes Side toes touching the ground; splint of 5th digit	Three Toes Side toes touching the ground	Short-Crowned, without Cement
	Eocene	UINTA BRIDGER	Protorohippus	Four Toes		
		WIND RIVER WASATCH	Hyracotherium (Eohippus)	Four Toes Splint of 1st digit	Three Toes Splint of 5th digit	
		PUERCO AND TORREJON		Hypothetical Ancestors with Five Toes on Each Foot and Teeth like those of Monkeys etc.		
Age of Reptiles	Cretaceous Jurassic Triassic					

able increase in the proportionate length of the limbs, and especially of the lower part of the leg and foot. The surfaces of the joints, at first more or less of the ball-and-socket kind, permitting of free motion of the limb in all directions, become keeled and grooved like a pulley, thus permitting free motion forward and backward, but limiting the motion in all other directions, and increasing considerably the strength of the joint. By this means the foot is made more efficient for locomotion over a smooth, regular surface, but less so over very rough ground, of little use for striking or grasping, or the varied purposes for which the feet of many-toed animals are used.

The increased length in the lower leg and foot increases the length of the stride without decreasing its quickness, for the heavy muscles of the leg are chiefly in the upper part, and to increase the length of the lower part changes the centre of gravity of the limb very little, and it consequently swings to and fro from the socket nearly as fast; for in an ordinary step the leg swings like a pendulum, and the speed of the swing is regulated by the distance of the centre of gravity from the attachment, as that of a pendulum is by the height of the bob.

To increase the length of lower leg and foot will therefore give the animal greater speed; but it puts an increased strain on the ankle and toe joints, and these must be strengthened correspondingly, by converting them from ball-and-socket joints to 'ginglymoid' or pulley joints. Additional strength, likewise at the expense of flexibility, is obtained also by the consolidation of the two bones of the forearm (ulna and radius) and leg (tibia and fibula) into one, the shaft of the lesser bone practically disappearing while its ends become fused solidly to its larger neighbor.

Corresponding with the increase in length of limb, it is necessary for a grazing animal that the head and neck should increase in length in order to enable the mouth to reach the ground. So in the modern horse we find the neck and head much elongated when compared with the little Hyracotherium, and this elongation has taken place at equal pace with the elongation of the legs. The reduction and disappearance of the side toes, and the concentration of the step on the single central toe, serve likewise to increase the speed over smooth ground. The soft yielding surface of the polydactyl foot is able to accommodate itself to a rough, irregular surface, but on smooth ground the yielding step entails a certain loss of speed. An illustration is afforded by the pneumatic tire of a bicycle; a 'soft' tire accommodates itself to a rough road, and makes easier riding, but a 'hard' tire is faster, especially on a smooth road. Similarly the hard, firm step from the single toe allows of more speed over a smooth surface, although compelling the animal to pick its way slowly and with care on rough, irregular ground.

The change in the character of the teeth from 'brachydont,' or short-crowned, to 'hypsodont,' or long-crowned, enables the animal to subsist on the hard innutritious grasses of the dry plains, which require much more thorough mastication before they can be of any use as food than do the softer green foods of the swamps and forests.

All these changes in the evolution of the horse are adaptations to a life in a region of level, smooth, and open grassy plains, which are the natural habitat of the horse. The race, better fitted at first for a forest life, has become more and more completely adapted to live and compete with its enemies or rivals under the conditions which prevail in the high, dry plains of the interior of the great continents. The great increase in size, which has occurred in almost all races of animals whose evolution we can trace, is dependent on abundance of food. A larger animal, as may be shown on ordinary principles of mechanics, requires more food in proportion to its size than does a smaller one, in order to keep up a proper amount of activity. On the other hand, a larger animal is better able to defend itself against its enemies and rivals. Consequently, as long as food is abundant, the larger animals will have the advantage over their smaller brethren, and by the laws of natural selection the race will tend to become continually larger until a limit is reached when sufficient food becomes difficult to obtain, and the animal is compelled to devote nearly all its time to getting enough to eat.

CAUSE OF THE EVOLUTION. The evolution of the horse, adapting it to live on the dry plains, probably went hand in hand with the evolution of the plains themselves. At the commencement of the Age of Mammals the western part of the North American continent was by no means so high above sea-level as now, great parts of it had but recently emerged, and the Gulf of Mexico still stretched far up the valley of the Mississippi. The climate at that time was probably very moist, warm, and tropical, as is shown by the tropical forest trees found fossil even as far north as Greenland. Such a climate, with the low elevation of the land, would favor the growth of dense forests all over the country, and to such conditions of life the animals of the beginning of the mammalian period must have been adapted. During the Tertiary the continent was steadily rising above the ocean level, and at the same time other influences were at work to make the climate continually colder and drier. These conditions restricted and thinned the forests, and caused the appearance and extension of open grassy plains. The ancient forest inhabitants must then either retreat and disappear with the forests, or adapt themselves to the new conditions of life. The ancestors of the horse, adopting the latter course, changed with the changing conditions, and the race became finally—as we see it to-day—one of the most highly specialized of animals in its adaptation to its peculiar environment. At the end of the Age of Mammals the continents stood at a higher elevation than at present, and there was a broad land connection between Asia and North America, as well as those now existing. At this time the horses became cosmopolitan, and inhabited the plains of all the great continents, excepting Australia.

It is a question whether the direct ancestry of the modern horse is to be searched for in Western America or in the little known interior plains of Eastern Asia. It is also unknown why the various species which inhabited North and South America and Europe during the early part of the Age of Man should have become extinct, while those of Asia (horse and wild ass) and of Africa (wild ass and zebra) survive. Man since his appearance has played an important part in the extermination of the larger animals; but there is nothing to show how far he was responsible for the disappearance of the native American species of horse.

Parallel Evolution in Other Races. It is interesting to observe that while the evolution of the horse was progressing during the Tertiary period in North America another group of hoofed animals, now extinct, the Litopterna, in South America evolved a race adapted to the broad plains of Argentina and Patagonia, and singularly like the horse in many ways. These animals likewise lost the lateral toes one after another, and concentrated the step on the central toe; they also changed the form of the joint-surfaces from ball-and-socket to pulley joints; they also lengthened the limbs and the neck; and they also lengthened the teeth, and complicated their pattern; but, unlike the true horses, they could not form cement on the tooth, and it was by no means so efficient a grinder. This group of animals, native to South America, became totally extinct, and were succeeded by the horses, which immigrated from North America, which in their turn became extinct before the appearance of civilized man. Many of the contemporaries of the horse in the Northern Hemisphere, such as the camels in America, the deer, antelopes, sheep, and cattle in the Old World, were likewise lengthening the limbs, lightening and strengthening the feet, and elongating the tooth-crowns, to adapt themselves to the changing conditions around them, but none paralleled the horse's evolution quite so closely as did the pseudo-horses of South America.

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For technical articles on fossil horses, consult the bibliography in Woodward, *Vertebrate Palæontology* (Cambridge University Press, 1898); and in addition Gidley, in Bulletin of the American Museum of Natural History (New York, 1900, 1901).

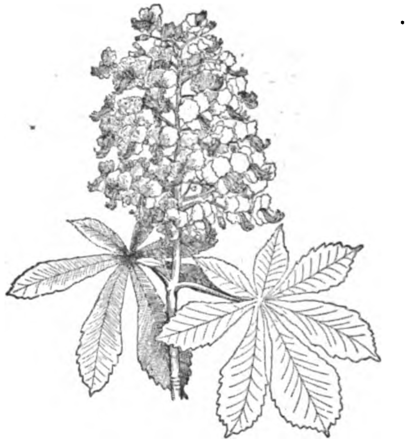
HORSE-ANT. A popular name for certain hymenopterous insects forming the family Mutillidæ. They are also known as 'cow-ants,' 'cow-killer ants,' 'solitary ants,' and 'velvet ants.' Although they resemble the true ants, they are more closely related in structure to the social wasps, in spite of the fact that they are not winged, and are solitary in their habits. They are ferocious stingers, and are clothed with hair, which is frequently brightly colored—often bright red. In their early stages some and possibly all are parasitic in the nests of wild bees.

HORSE ARTILLERY. Cannon for use with cavalry troops or flying columns of any kind where great mobility is required. In horse artillery all the personnel is mounted, and the gun is lighter than the ordinary field gun. Horse artillery must be mobile enough to keep up with the cavalry in attack and pursuit. When cavalry charges cavalry, the horse artillery takes up a position and fires upon the enemy's horse. In successful attack it follows its cavalry; in defeat it covers retirement.

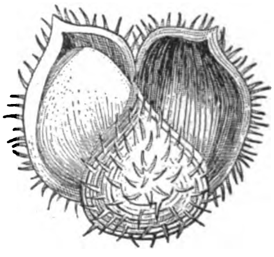
In the English Army, which in 1900 had 18 batteries of horse artillery in the home establishment and 11 in India, the gun used is the 12-pound breech-loader, calibre three inches, firing shrapnel (q.v.), shell, and case-shot. See Artillery; Field Artillery.

HORSE-BOT. The bot-fly of the horse (*Gastrophilus equi*). See Bot.

HORSE-CHESTNUT (so called probably from the large size of the nuts; less plausibly explained from the former use of them when ground as food for horses), *Æsculus*. A genus of trees of the natural order Sapindaceæ in which the leaves are large opposite digitate; flowers with five spreading unequal petals, and the capsule leathery, three-valved, and covered with soft spines. The seeds, of which there are from one to three in each fruit, are large and somewhat resemble chestnuts; but the habit of the trees, its leaves and flowers, are very unlike those of chestnuts, with which it has no botanical affinity. The common horse-chestnut (*Æsculus Hippocastanum*) is a much esteemed ornamental tree, very frequently planted whenever the climate is suitable, on account of its rich foliage and its erect racemes of beautiful reddish-white flowers, which are produced on the extremities of the branches, and contrast admirably with the dark green of the leaves. It is supposed to be a native of Persia or some parts of the East, and was introduced into Western Europe from Constantinople at the end of the sixteenth century. It attains a great size, sometimes rising to the height of 100 feet, and extending its branches very widely. Sometimes they droop almost to the ground. The leaves have long stalks, and five to seven obovate wedge-shaped leaflets. The wood is soft, not very strong, nor very durable in the open air; but is used for many ordinary purposes, and by carvers, turners, etc. The bark is bitter and astringent, contains a bitter principle called *œsculine*, and has been used in tanning and dye-

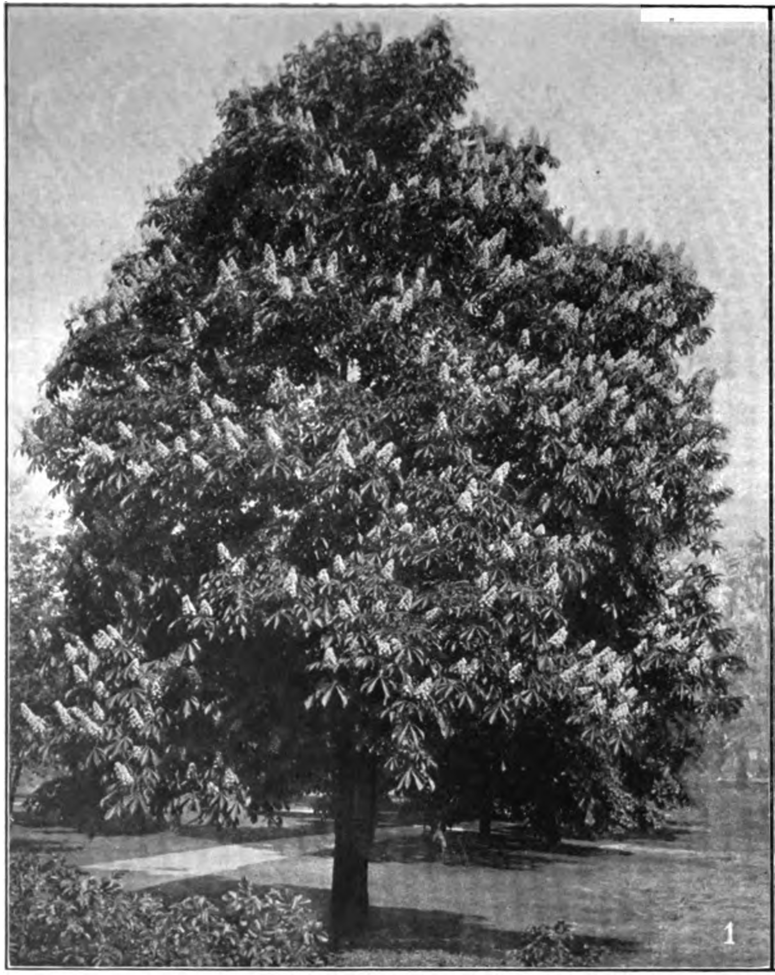


A HORSE-CHESTNUT TWIG.

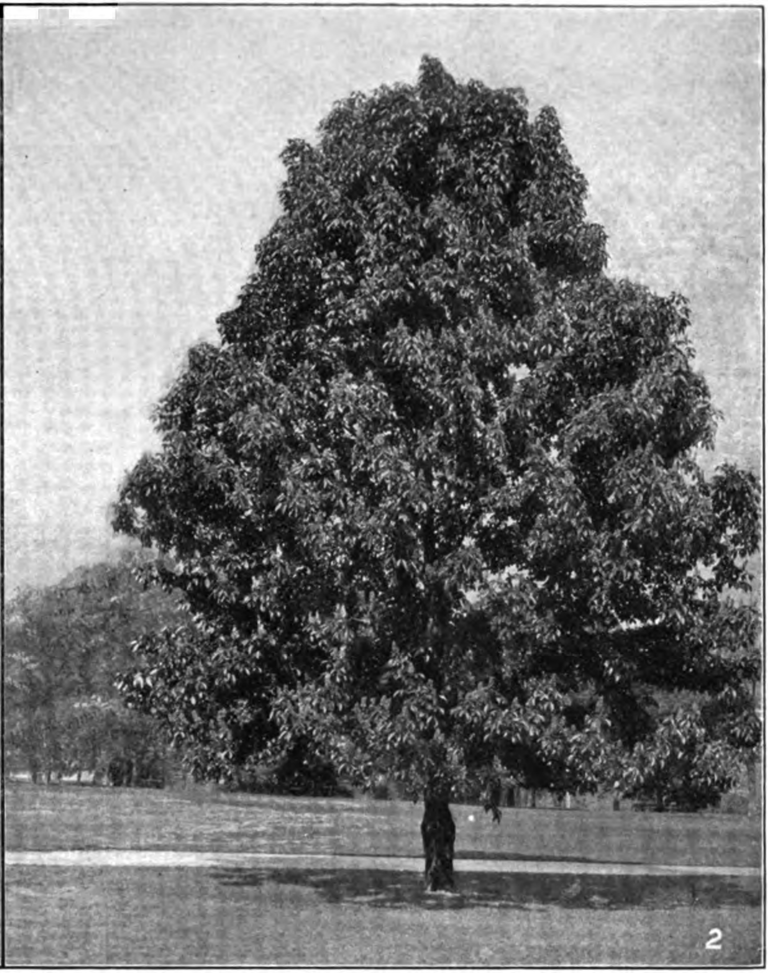


HORSE-CHESTNUT FRUIT.

HORSE CHESTNUT



1. HORSE CHESTNUT TREE (Æsculus Hippocastanum) IN BLOOM



2. OHIO BUCKEYE (Æsculus glabra).

ing. The seeds are unpleasantly bitter, and contain so much of the saponaceous substance peculiar to this natural order that when reduced to powder they may be used for washing. They contain, however, a large quantity of starch, which may be extracted and freed from bitterness by means of an alkaline solution or repeated washing. This starch is prepared on a large scale and at a cheap rate in France. Horse-chestnuts have long been employed in various countries as food for oxen, sheep, swine, and horses, all of which are fond of them, and grow fat upon them.

In the other species of Æsculus which are natives of North America the foliage is very similar to that of the common horse-chestnut. Both the leaves and fruit of the American buckeye (*Æsculus glabra*) are poisonous. This tree ranges from Pennsylvania to Alabama, and west to Kansas and Texas. North America possesses a number of other species with very similar foliage, smaller flowers, and smooth fruit. In California the seeds of *Æsculus California* are used as food by some Indian tribes, as are those of *Æsculus turbinata* in Japan. The seeds of *Æsculus parviflora*, the edible buckeye, are eaten, either boiled or roasted. This species is a shrub with long and beautiful racemes of fragrant white flowers, which have long projecting stamens. It is a native of the Southern States. *Æsculus Indica* is a lofty tree which grows at elevations of 8000 to 10,000 feet in the Himalayas, and produces seeds very similar to those of the horse-chestnut, which, although bitter, are eaten in time of scarcity.

HORSE-CREVALLÉ, kre-vȧl-lā′. See CAVALLY.

HORSE FAIR, THE. A well-known painting by Rosa Bonheur, exhibited at the Salon of 1853. After passing through several hands it formed part of the Stewart collection, and was finally purchased by Cornelius Vanderbilt, and presented by him to the Metropolitan Museum, New York, where it now hangs. There are several replicas by the artist in England, and an engraving of the painting by Landseer. The canvas shows a number of horses in motion, some with riders, some led, and some free.

HORSE-FISH, or HORSEHEAD. See MOONFISH.

HORSE-FLY. See GADFLY.

HORSE-FOOT SNIPE. See TURNSTONE.

HORSE-GENTIAN. A North American medicinal plant. See FEVERWORT.

HORSE GRENADIERS. See MOUNTED INFANTRY.

HORSE GUARDS. The military headquarters of the British Army, and the offices of the Field-Marshal Commander-in-chief, War Office, Pall Mall, London, S. W. It is a term used to distinguish the purely military part of the army organization from that of the civil authority, the Secretary of State for War. The oldest cavalry regiments of the British Army are also known as the Horse Guards, the term including the Oxford Blues, first raised by the Earl of Oxford in 1660, and now styled the Royal Horse Guards, or The Blues; and the First and Second Regiments of Life Guards (q.v.), organized in 1661-62.

HORSE LATITUDES. See CALM LATITUDES.

HORSELESS CARRIAGE. See AUTOMOBILE.

HORSE-MACKEREL. A name given to several species of fishes of the family Carangidæ, and especially, in Great Britain, to the scad (*Trachurus trachurus*), and in the United States to the crevallé (*Caranx hippos*). The carangids are all trim, vigorous fishes, and are peculiar in that the teeth, when present, are villiform or conical. Usually the scales are very small, or they may be altogether wanting. In many instances the lateral line is entirely or partially armed with shield-like, overlapping plates. (See Fig. 2, on the Plate of HORSE-MACKEREL, accompanying this article.) The horse-mackerels are distributed over all seas except the polar, and their remains go back to Cretaceous time, while they are profusely represented in marine strata of Eocene date. They sometimes gather in enormous shoals, and are captured in vast quantities in seines. They are carnivorous, and swift and fierce in pursuit of lesser fishes. Their flesh is excellent food. The typical genera are slender, compressed, mackerel-like fishes, but the family includes many others of different form, such as the amber-fishes (Seriola), the pilot-fishes (Naucrates), the moonfishes (Vomer and Selene), and the pompanos. These are described individually under their names elsewhere. Consult Goode's *American Fishes* (New York, 1888); Gunther, *Introduction to the Study of Fishes* (London, 1880).

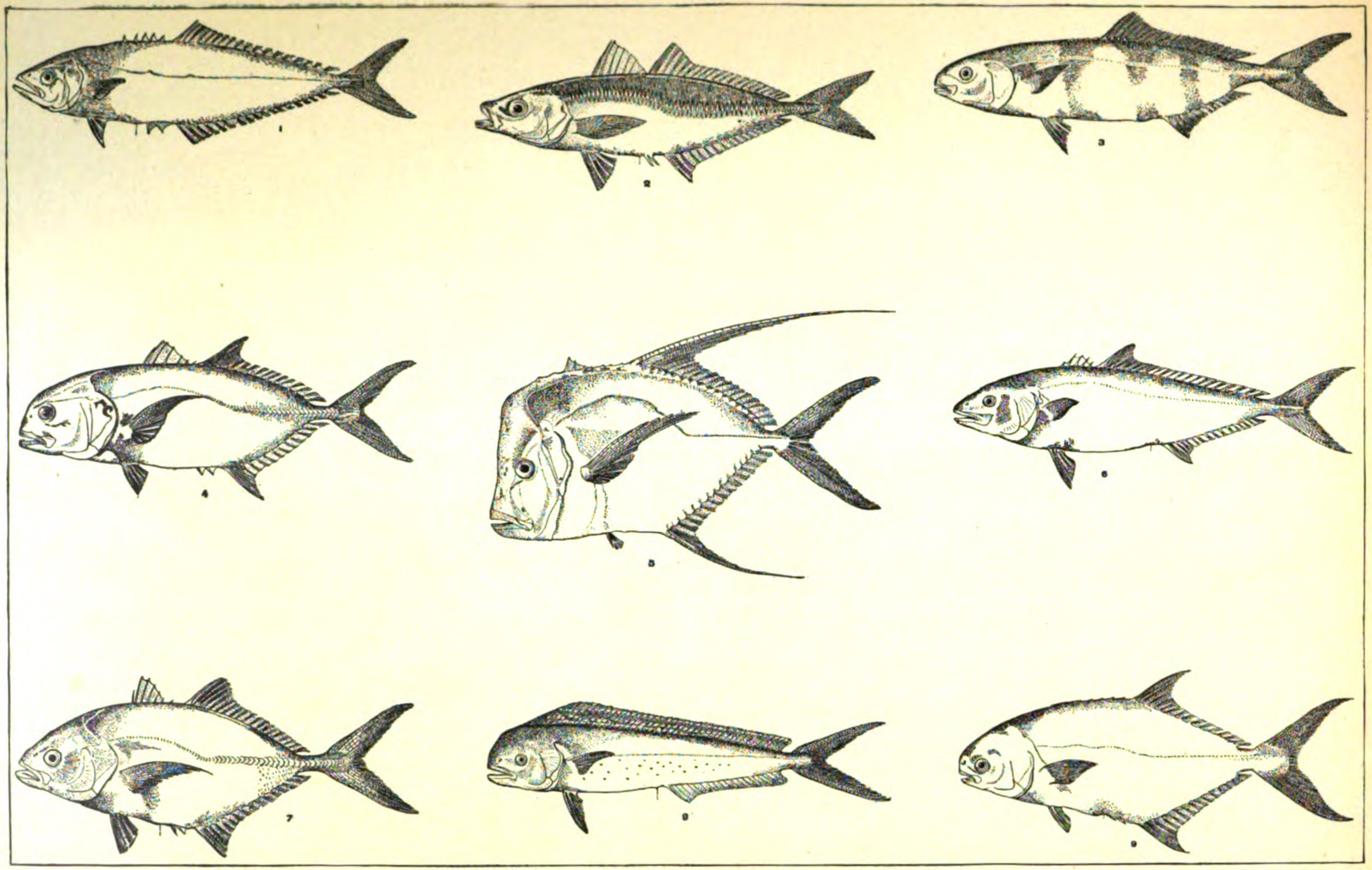
HORSEMANSHIP. The art of managing horses. It is to the Greeks that we must look for our first knowledge of the history of horsemanship, for when primitive man first ventured upon the back of a captured horse is, at the best, a matter of conjecture. The 'bit' could not have been known before the age of bronze, but undoubtedly the first horsemen employed a halter or thong of rawhide passed through the animal's mouth in order to direct and control it. According to the evidence of the Egyptian monuments, bit, bridle, harness, and chariot were employed; and we know from other sources that the bridles of the early horsemen of Egypt and Asia were considerably decorated with tassels, crests, and embroidery, in a manner both rich and elaborate; but anything approaching the modern saddle was unknown to either Egyptian, Assyrian, or Persian. Instead, a decorated and fringed cloth fastened to the animal by a girth was employed to afford the horseman a seat. The warlike tribes occupying the northern border of Greece are credited with the introduction of horsemanship among the Greeks, among whom the art was held in very high esteem. Horse-races were a conspicuous feature of their festivals and games; a noteworthy feature in connection with which was the fact that the tact and judgment of the rider was frequently a more important factor in gaining the decision than the superiority of the horse. The Athenians were especially devoted to the art, and the rules of horsemanship, so far as the seat is concerned, did not differ in essence from the good horsemanship of to-day. That the Greeks excelled in the exercise is evident from the fact that they were in the habit of taking all sorts of 'leaps' (according to Xenophon), "across ditches, over walls, upon and from banks;" and in military evolutions particularly, demonstrated their mastery of the art of equitation. The stirrup was not known to the Greeks, and probably its absence helped to make them the finished horsemen they undoubtedly were. The Romans undoubtedly learned the art of horsemanship from the Greeks, and, in fact, ascribed the inventions of bridle and chariot, as well as attributed the first conquest of the horse, to their teachers. With the Romans as with the Greeks, equestrianism was a conspicuous feature of their games; and in the time of Cæsar the youths of the aristocracy vied with each other in the practice and public exhibitions of difficult feats of horsemanship.

MEDIÆVAL HORSEMANSHIP. Although there is no proof of the fact, it is nevertheless probable that the saddle-tree had been used for pack-animals from a very early date, and that the riding saddle in some form or shape was known before the fifth century B.C., the era of its reputed first appearance. The difficulty of mounting into the saddle encumbered with heavy armor led through a series of contrivances to the introduction of the stirrup. While the horsemanship of the age of chivalry cannot be said to compare with that of the Greeks and Romans, the demands of the tournament prevented its being neglected.

MODERN HORSEMANSHIP. The first treatise upon the subject was that published by Federigo Grisoni, entitled *Gli ordini del cavalcare* (Naples, 1550). A contemporary of Grisoni was the celebrated teacher Pignatelli, who is regarded by many as the author of the foundation of our present system of riding. Two of his pupils, La Broue and Pluvinel, became famous throughout Europe. Subsequent important writers and their works in England are: Blundeville, *The Fower Chiefest Offices Belonging to Horsemanshippe* (c.1570); translations from the Italian, by Gervase Markham (1593) and Sir William Hope (1696); Thomas de Gray, *Compleat Horseman and Expert Farrier* (London, 1639). The Duke of Newcastle's *Méthode nouvelle de dresser les chevaux* (Antwerp, 1648) was first written in English, and afterwards translated into the language in which it was published. It was for a long period regarded as the great standard authority on horsemanship, although to-day its teaching would be regarded as impossible. Cavalry horsemanship was the subject of a little manual published by the Earl of Pembroke in 1761.

At the present time there are several methods of mounting a horse, each one with its own distinct advantages and disadvantages. Ordinarily, the young horseman is taught to mount from either side, but usually from the 'near' or left side of the horse. The common English method is to place the snaffle rein round the third finger of the left hand, grasp a wisp of the horse's mane between the finger and thumb of the same hand, placing the left foot in the stirrup, and the right hand on the cantle, then with a spring the right leg is thrown over the horse and the rider seats himself in the saddle, meanwhile releasing the mane. He next secures the curb reins in the left hand, in such a manner that the left rein is outside the little finger, and the right between the first and second fingers. When the rein has been drawn in sufficiently for the rider to feel the horse's mouth gently, the loose part or slack is thrown over the first finger and held between that and the thumb. In America both reins are placed in position in the left hand before mounting. The whip in mounting is held in the fork of the thumb of the left hand and afterwards taken into the right hand. The manner of holding the reins differs in different countries of Europe as well as in America, the more general method, other than that of the English already described, being its exact opposite in that the curb is held inside the snaffle. Upon mounting, the rider should firmly seat himself in the middle of the saddle, which ought to be placed well behind the rise of the shoulders, his legs, which should work in sympathy with his hands, just about covering the girth, so that when using leg pressure to the horse, it may be easily and effectively applied immediately behind the girth. The elbows should hang loosely and naturally from the shoulder, permitting a free use of the hands, which latter should always be in a position to 'give and take' without compromising control over the horse, irritating, or otherwise fretting him. When riding at a walk the horseman should maintain a natural upright position, the legs from knee to heel remaining perfectly straight; toes a little higher than the heels, the feet horizontal with the horse's body. The action of the leg, like that of the hand, should be sensitively active and supple, exerting as little pressure as possible, but ready and in position to exert sufficient pressure to maintain the rider's seat and position under any and all circumstances. A beginner will find it to his advantage to practice guiding his horse in every possible manner and direction, selecting for this purpose some inclosed place, as a riding-school, inclosed yard, etc. The horse must at all times be kept well up to the bit, and the rider will do well to remember that guiding the horse military fashion by the pressure of the reins on the animal's neck is not generally advised. *Pacing* in America and *ambling* in England are practically the same gait. The two legs on each side rise and fall together. It does not call for any different method of riding than that employed for the walk. The *trot* is a diagonal pace, the right fore and left hind legs working together and alternately with the left fore and right hind legs. To make the animal trot, raise its head slightly, and press its body with the knees and side of the leg below the knee, and, if necessary, touch it with the whip, but not under any consideration should the rider give any indication by sound of mouth. Serious accidents frequently happen because of the disregard of this very necessary precaution. The horse of a fellow rider is apt to answer to the command, and possibly unseat its own rider, owing to his unpreparedness. The trot is possibly the most perfect pace of the horse. The body should be erect, but playing loosely from the hips; the legs must not be allowed to swing backward and forward, nor must the rider work his shoulders. The expert horseman rides by the aid of grip and balance, the former always ready should the balance be disturbed and there be any danger of a throw. The pressure of the legs should be according to the demand of the moment, ready to keep the rider from losing his balance, which latter saves the strain of a constant exercise of the grip. The *canter* is a very comfortable pace to the rider. It is not a natural pace, however, but, on the contrary, is fatiguing to the horse, and particularly injurious to the animal's

HORSE MACKEREL



1. LEATHER-JACKET (Oligoplites saurus).
2. SAUREL (Trachurus trachurus).
3. PILOT-FISH (Naucrates ductor).
4. CREVALLE (Caranx hippos).
5. MOONFISH (Selene vomer).
6. YELLOWTAIL (Seriola dorsalis).
7. JUREL (Caranx latus).
8. DOLPHIN (Coryphæna hippurus).
9. POMPANO (Trachynotus Carolinus).

fore legs. When cantering in a circle the horse should be made to lead with his inside leg, i.e. with the right leg if cantering to the right, and with the left if cantering to the left. To secure this the rider when preparing to canter should pull the right rein rather tighter than the left one, so that the horse in describing a small portion of a circle will, of necessity, lead with the right leg. *The Gallop.*—In this pace the movements of the horse follow so quickly one on the other that the eye cannot detect the various positions which constitute a cadence. The first preparation for the rider is a firm seat, which should be well down in the saddle. The reins are shortened slightly, and the hands kept low; at the same time the body should be leaning slightly forward and a moderate grip maintained with the legs. Care must be taken that the horse is held together and restrained from breaking into a headlong gallop, and possibly beyond the rider's control. To avoid this the reins are held somewhat tighter in the gallop than in any of the other paces.

Leaping requires good nerves as well as a good seat. The rider must be careful to maintain an upright position in the saddle until the horse is close to the jump, when (if it is a fence) he should swing well back from his hips, keeping his hands low and clear of the withers. The feet should be drawn back, and never under any circumstances allowed to swing forward toward the animal's shoulders. Should the feet be forward and the horse make a mistake on landing, the rider would be more easily thrown than if his feet were in the proper position. In brief, the rider should in every form of leaping keep his body at right angles to the ground; thus, the higher the jump, the more he will be required to lean back. In landing, the horse makes contact with the ground on one fore leg followed instantly by the other, after which come the hind legs. When jumping natural obstacles, such as water, ditch, etc., the general rule never to ride fast at an obstacle holds good, although expert horsemen interpret the rule to suit themselves; in any event, the rider must be careful not to pull at the reins or in any way check the horse in his effort to jump either water or ditch. Much depends on the horse in leaping, no two going at the jump in exactly the same style. One may need a little encouragement and another a great deal of steadying, so that it is an important essential for the rider to know his horse. When nearing the jump, the reins should be tightened so as to secure a firm hold of the head and at the same time make him shorten his stride so that he may the better gauge his distance. It requires some little experience on the part of the rider before he is able to tell when the horse is in his proper stride. When the animal is properly collected, and is nearing the obstacle, the hold on the reins should be relaxed and care taken that the free action of his head or limbs is in no way interfered with by pulling, etc. On landing the rider should gently feel his mouth. The horse will then collect himself, all four legs will make contact with the ground, and he will be away again without any hesitation.

The common vices of shying, bolting, kicking, rearing, etc., are much more serious in a horse kept for the saddle than in one used for driving. The horseman will usually be able to tell when his mount is about to shy, so that he will slacken the pace gently, and at the same time keep a firmer hold upon the rein on the side toward which the horse is leaning. On no account should he prepare for it by giving his horse any intimation that something unusual is to happen; neither should he whip or spur, or, as is sometimes done, strike him on the head on the side toward which it is feared he will plunge. The important thing for the rider is to grip fast with the legs, preserve his balance, and be careful not to hang on by the reins. If necessary, stop and encourage the horse by patting him on the neck and otherwise making much of him.

Perhaps the most dangerous vice next to rearing is that of *bolting* or *running away*, which in many instances, however, is only exuberance of spirits on the part of the horse which temporarily overcomes the control of the rider. With a skillful and ordinarily strong horseman it is very rarely that a horse runs away, but where such does happen the method of combating it will depend very much on the country and route the runaway selects. Where the route abounds with sharp turns or shut gates, the danger to be feared will be the running into a fence or gate; but on a road not much frequented and well known to the rider, it will generally be possible to guide the horse past any vehicle which may be met or overtaken. In such a case the rider should not hesitate to turn the rein around his hand and pull with all his strength toward the side he desires the horse to take. 'Sawing the mouth,' though not horsemanship, is permissible, if by its employment only the runaway can be brought to a standstill. A kicking horse should be approached and treated very carefully, and if a vicious kicker should, if possible, be just as carefully avoided. The rider usually has some sort of warning, such as the laying back of the animal's ears, in which case he should sit well back and secure his grip. Only the expert horseman should attempt to ride a rearing horse; for no amount of nerve will suffice to guard the rider from the terrible injuries likely to occur if a rearing horse should fall back on him. Of all horses, the rearer should be the most carefully shunned. There is only one thing for the rider to do in such an emergency—to remember not to hold the reins tight or use them in any way as a support. On the contrary, he should catch hold of the horse's mane, or place an arm round his neck and try in that manner to force him back on his feet.

Military horsemanship is designed to secure a uniformity of style and method, and the best results from both horse and rider. Long stirrups are used; the rider sits well down in the saddle, his seat being preserved largely by balance. *High school* riding is largely an accomplishment of the manège, and includes skill in horsemanship, and in the performance of feats requiring a trained animal. Women are now taught to ride astride, as well as by means of the side-saddle. Hygienic reasons are advanced in favor of the former method, but authorities generally are doubtful of their reasonableness. A fair statement of the question would be that a poor horsewoman derives little benefit from either method, and runs a minimum of risk of injury when riding astride; a clever horsewoman will invariably ride side-saddle with a greater degree of comfort, enjoyment, and safety, than when riding astride.

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HORSE-MEAT. See HIPPOPHAGY.

HORSE-MUSSEL. The large mussel (*Modiola modiolus*) growing abundantly on salt meadows as well as under water. See MUSSEL.

HORSE-NETTLE. See SOLANUM.

HORSENS, hŏr′sĕns. A seaport of Denmark, in the Province of Aarhus, situated at the head of the fiord of Horsens, 25 miles southwest of Aarhus (Map: Denmark, C 3). The town possesses a fine church with carvings of the seventeenth century, an old convent chapel, and a high school. The chief industries are weaving, iron-working, ship-building, and the manufacture of woodenware and lime. The town carries on an active trade, importing grain, hay, and fertilizers, and exporting dairy products, pork, and beef. Population, in 1890, 17,290; in 1901, 22,232.

HORSE-POWER. A unit of rate of work, used to measure the performance of motors. It is based upon the assumption that horses in general perform a certain constant amount of work in a specified time; an assumption which is evidently erroneous. The fundamental unit of work is the foot-pound (q.v.); but in measuring the work of a horse by this unit, the estimates of the most celebrated engineers differed widely from each other. Boulton and Watt, basing their calculations upon the work of London dray-horses (working eight hours a day), estimated it at 33,000 foot-pounds per minute. D'Aubuisson, taking the work done by horses working on capstans at Freiberg, estimated the work at 16,440 foot-pounds, working eight hours a day; under similar circumstances, Desagulier's estimate was 44,000; Smeaton's, 22,000; and Tredgold's, 27,500 foot-pounds. It matters little, however, what number is assumed, provided the same be always used; and accordingly the original estimate of Watt is still counted a horse-power. In calculating the power of a steam-engine in terms of this unit, the general rule is to multiply together the pressure in pounds on a square inch of the piston, the area of the piston in inches, the length of the stroke in feet, and the number of strokes per minute; the result divided by 33,000 will give the horse-power. There is an increasing tendency, particularly in electrical machinery, to use the kilowatt as a unit of rate work. This unit is equal to $\frac{746}{1000}$ of a horse-power.

HORSE-RACING. The earliest recorded organized trials of speed with horses were the chariot-races at the Greek national festivals, of which the most notable were the Olympic games (q.v.), held every fourth year. Greek sculpture frequently represents the horse as used for riding, apparently without a saddle in most cases; but not as so employed for sport, except as an incident to the chariot-racing. On the other hand, the horses in the Roman contests were to a very great extent ridden. All the formalities of entering, and of differentiation of classes, and of starting were minutely laid down and followed, even to the color of the riders' uniforms. In the earlier times these Roman races were held on the open plain. There has always been a tradition in England that on Salisbury Plain, just outside Stonehenge, the remains of a Roman racecourse exist; and the oldest race which still takes place in England is run over a flat meadow just outside the walls of the Roman city of Chester. In fact, the conclusion seems almost certain from the similarities in officers and methods that horse-racing was one of the legacies left to Britain by its Roman conquerors. The natives, too, were great horsemen and charioteers, and contests were likely enough to be provoked at the feats which the Romans took with them the world over. Their successors, the Saxons, maintained the use and training of the horse; when Hugh Capet sought the hand of the sister of King Athelstan, in the ninth century, he brought as a propitiatory present several 'running horses.' Fitzstephen, in his description of the city of London, written at the end of the twelfth century, says that "races are common, of which the gentry and wealthy citizens are very fond." In the metrical romance of "Bevis of Hamtoun," we get our first glance of a regular recurring annual meet of racing horses. In 1540 the Mayor of Chester presented a silver bell to be given to the winner of a race five times round 'The Roody.' The horse that won not only bore away the bell, but eight or ten pounds, "which moneys were collected of the citizens for that purpose." By the reign of James I. (1603-25) public race meetings were held at Garterly in Yorkshire, Croydon in Surrey, Linton in Cambridgeshire, and on Enfield Chase. In the days of his successor, Charles I., Newmarket, now the metropolis of the racing world, first came into prominence, and Oliver Cromwell, whose farm at Coveney was only a few miles from Newmarket, bred and kept race-horses. Charles II. was a great patron of the turf. He built a house at Newmarket, and was a regular attendant there. From that time onward modern flat racing has a uniform history of progress.

The horses that practice flat racing are known the world over as thoroughbreds, yet as a matter of fact they are the product of cross-breeding continued for many centuries. Vegetius, who wrote in the fourth century, gave to African horses of Spanish blood the first place as chariot-racers, but commended the Persian as the best saddle-horse. James I. bought a very celebrated Arab for breeding purposes; but the Darley Barb, imported in 1705, laid the foundation (through his great-grandson Eclipse, born 1764) of the modern turf. He was the sire of Almanza and Aleppo, but his best-known son was Flying Childers. This importation was followed by many others of sires and dams, among which the Taffolet Barb and the white-legged Lowther Barb are the best known. The Byerly Turk produced Highflyer, and the Godolphin Arab was the grandsire of Matchen. Among the horses whose names have become household words may be mentioned: Diomed (who won the Derby in 1780 and was imported to America); Bay Middleton, The Flying Dutchman, West Australian, Blink Bonny, Hermit, Galopin, Bend Or, Saint Simon, Saint Blais, Ormond, and Persimmon.

There is no radical difference between the methods of training horses for flat racing in England and America, except in the time of taking the foal in hand. In England the majority of foals are practically left to nature until well into the second year. In America, on the other hand, so considerate a trainer as W. E. Wishard would have them backed when weanlings at nine months, and tried out when fifteen months old. But then, in California, owing to climate and grass, the young ones mature very quickly. In England the training of the young racer commences in his second year under a trainer. A thorough preparation for a great race is a long and troublesome operation, depending largely upon constitution, general capacity, and temperament. Ordinarily the colt is gradually brought from a naturally loose condition to the greatest perfection possible; first by steady and continuous walking exercise, then proceeding by gradual stages to gentle galloping and sweating, and finishing by testing the capacity of the colt against a competitor at a distance equal to the forthcoming race. It has been found that, practically, the speed of almost all horses can be equalized by addition or subtraction of weight to be carried when running; and so nicely is this adjusted that the handicaps arranged on this principle provide some of the best races in the year. See HANDICAPPING.

The most celebrated race-course in England is Newmarket, established in 1667, where the Cambridgeshire, the Cesarewitch, the 1000-guineas, and the 2000-guineas are annually run. There are six meets there in the year, in May, July, and October, each occupying two weeks, with an interval of a week between them. The Derby (see DERBY DAY) has been run at Epsom since 1730, and the Oaks since 1779. The Ascot meeting has been continuous since 1727, and Goodwood since 1802. The other most important races are at Doncaster, Lincoln, Chester, and on the Curragh of Kildare, Ireland. The Jockey Club, a semi-public organization, is the flat racing authority. In France within the last thirty years great interest has been taken in breeding and racing the thoroughbred. The Grand Prix de Paris, which is run at Longchamps, near the capital, is one of the great races of the world. Austria, too, has its enthusiasts, and in Australia flat racing is a national pastime.

In America, the first and natural home of the thoroughbred was in the South, where the early settlers were of the class which in England made the breeding and care of high-mettled horses one of their delights. Many well-known horses were imported. Diomed, the Derby winner already mentioned, of the Byerly Turk blood, was one of them. He was brought over by Col. John Hoomes, of Virginia, and became the sire of Sir Archy, who in turn was the father of American Eclipse, Vingt Un, and other well-known horses. Another of these importations was Messenger, by Blais (the son of Flying Childers and grandson of the Darley Barb) out of Turf, a descendant of the Godolphin Arabian, thus combining on both sides the best thoroughbred blood in the world. Breeding continued with great success; so that in 1881 the late Pierre Lorillard was able to send over to England his Iroquois and win the Derby. Breeding establishments known all over the world are scattered throughout Kentucky and Tennessee, and there are many enthusiastic owners of thoroughbreds.

Even in the North, flat racing flourished as early as 1812. In 1830 Barefoot, a Saint Leger winner, found a home in Westchester, N. Y., and was raced there against his great rival American Eclipse. The Wagner-Grey Eagle contests caused unparalleled interest there in the autumn of 1839; and Lexington and Le Comte had their famous meetings in New Orleans in 1854-55.

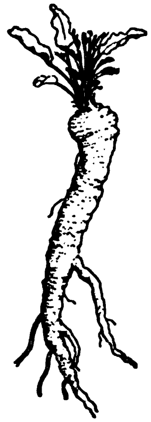
The Civil War was a temporary check to thoroughbred racing, and although scarcely a city of any size was without a course, it was not until the American Jockey Club was formed, with the late August Belmont as chairman, and Jerome Park (in 1886) was made the Mecca of the sport by Leonard W. Jerome, that racing in the modern sense became a widely spread pastime. In 1881 the Coney Island Jockey Club opened the Sheepshead Bay Track; in 1888 Mr. John A. Morris built Morris Park; the next year Monmouth Park at Long Branch was created by Mr. Withers, and this was followed by the Brooklyn Jockey Club's course at Gravesend. On these four courses sums approaching $500,000 were annually added to the entry fees, for competition. Saratoga has long had an annual meet of importance, and the Washington Park Club of Chicago and the Kentucky Racing Association have an antiquity greater than any of the Eastern associations. Other important racing centres are New Orleans, Louisville, Little Rock, Ark.; Roby, Ind.; Newport, Ky.; and Washington, D. C. The Pacific Slope is represented by the San Francisco Jockey Club and the New California Jockey Club, whose principles are gradually coming into accord with those guiding the Eastern Jockey Club, probably with a view to an often discussed amalgamation.

Many noted horses, besides Iroquois, already mentioned, have been produced in America, of which the best known have been Lexington (a direct descendant of Diomed), Silver Fox, a son of Blais, Maud Hampton, Kentucky, Tournament, Firenze, La Tosca, Ethelbert, Salvator, Imp, Kinley Mack, Ballyhoo Bey, Commando, Tommy Atkins, and Nasturtium.

One fundamental difference between American and English thoroughbred race-courses is that the former are bare earth floors, and the latter are covered with a close-fitting carpet of grass. The straight mile record on the grass was, singularly enough, made at Lingfield by the American bred Caiman in 1 m. 33 s.; while on the dirt course the mile record on a circular track was made by an imported horse, Orimer, at Washington Park, Chicago, in 1 m. 38 s.

The advent of American jockeys in England in the years 1900-01 worked a complete revolution in the style of riding in a flat race, and their fame has extended to every part of Europe where thoroughbred racing exists. The main point in the American style is the placing of the jockey's weight well forward on the horse's withers and a crouching attitude, which reduces the resistance of the air against the jockey's body.

HORSERADISH (*Cochlearia Armoracia*). A perennial herb of the natural order Cruciferæ, with long, cylindrical white roots of strong pungence, due to a volatile oil which resembles mustard oil. It has flower-stems about two feet high, large, much-veined, oblong, crenate root-leaves on long stalks, and elongate-lanceolate stem-leaves. It grows in damp meadows in the middle and south of Europe, is naturalized in many places in America, and is cultivated for the sake of its roots, which are scraped or grated down and mixed in salads or used as a condiment. Horseradish-root is used also in medicine as a stimulant, and is often useful in promoting digestion; it is also regarded as an antiscorbutic, and is sometimes applied as a rubefacient instead of mustard. Since horseradish does not produce seed, it is generally propagated by root-cuttings planted in rich, moist soil and treated as an annual. The crowns are also sometimes used, but they do not produce as good roots. Horseradish is very difficult to eradicate from the ground in which it has become established, as almost any portion of the root will grow.


ROOT OF HORSERADISH.

HORSERADISH - TREE (*Moringa pterygosperma*). A tree of the natural order Moringeæ, native of India, and introduced into the West Indies and other tropical countries, in many of which it is cultivated for its fruit, which is either pickled or eaten as a vegetable. The fresh root and the leaves suggest the odor and flavor of horseradish—hence the common name. Its winged, triangular, globose, bitter seeds furnish about 30 per cent. of a bland, inodorous, nearly colorless fixed oil of long-keeping qualities which resembles olive oil and is similarly used. At a temperature of about 32° F. a deposition of its solid fats occurs, and the remaining clear fluid is removed for use in the extraction of perfumes from flowers, and the lubrication of delicate machinery. The oil is known as ben-oil or behen-oil, a name which is said to be misapplied, since it is claimed properly to belong to the oil obtained from the wingless seeds of Moringa aptera, a tree native to Abyssinia and Arabia. The oil of neither species should be confounded with bene-oil, which is derived from the seeds of Sesamum indicum. See SESAMUM.

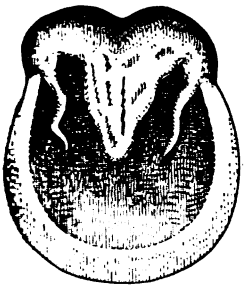
HORSESHOE BAT. See BAT.

HORSESHOE, or HORSEFOOT, CRAB. See KING-CRAB.

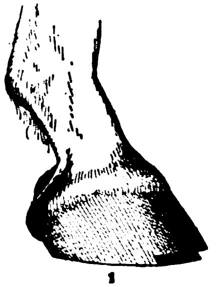
HORSESHOE FALL. The name given to the portion of Niagara Falls included between Goat Island and the Canadian shore, also called the Canadian Fall. See NIAGARA RIVER AND FALLS.

HORSESHOEING. An artificial protection of some kind for the horse's foot has been well said to be "one of the penalties which civilization inexorably exacts." When it is remembered that every time that a horse is shod it implies damage to the foot and that the best and most expert shoeing of necessity inflicts some injury, the importance of horseshoeing to the horse-owner is evident. All authorities agree "that there is no such thing as absolute immunity from an evil which must always exist in inverse ratio to the skill displayed in the execution of the work." The value of the domesticated horse to man is in his fleetness and strength. It was early discovered, however, that his usefulness was limited by the condition of his feet, so that the history of horseshoeing is practically an account of the various devices that have led up to the modern shoe.

The entire weight of the body, as well as the pressure of every muscular effort, is largely concentrated in the feet. The nails or claws and their corresponding digits of other animals have in solipeds disappeared from atrophy, with the exception of the middle digit, which became much more developed and surrounded by an hypertrophied nail called the hoof, the structure of which is designed to meet every requirement of the animal except those that have devolved upon it since its domestication, such as constant traveling over hard roads or stony ground. Should the horn of the hoof be worn away, the structures which it was designed to protect are of necessity injured, the animal becomes lame, unable to work, and consequently ceases to have any value. According to Diodorus, Cinnamus, and Appian entire armies were occasionally jeopardized through the breaking down of their horses by reason of worn hoofs. Xenophon sought to solve the problem by making the hoofs hard and tough; and from other Greek and Roman writers we learn that resort was had to socks or sandals (*ippopodes, embatai, carbatinai, solea,* etc.). These were clumsy as well as ineffectual means of protection, but, strangely enough, they have their modern counterpart in the straw sandals still to be seen in various parts of the Japanese Empire. According to Beckmann, *Beiträge zur Geschichte der Erfindungen* (Leipzig, 1792), it was greatly to be doubted whether the Romans practiced, as was alleged, the art of shoeing, by attaching a metal plate or rim to the horse's foot; a doubt strengthened by the fact that on no monuments or sculptures (so far as was then known) in which horses appear could any evidence of shoeing be seen. On the other hand, a bas-relief dating from the second century, at present in the museum of Avignon, shows a chariot drawn by horses which are unmistakably shod; and Cohen in his *Description des monnaies frappées sous l'Empire Romain* tells of a medal supposed to date from the time of Domitian commemorating a cavalry victory upon which was a design of two horseshoes, surrounded by two twined serpents. Another coin, in the British Museum, from Tarentum, about B.C. 300, is supposed to represent a horse being shod. According to historical writers the horses of the Huns when they invaded Europe were shod. Some evidence that nail shoes were employed previous to the sixth century is perhaps supplied by Chifflet (*Monuments de la monarchie Française*), who tells of a fragment supposed to be part of a horseshoe found by him at Tournay in the tomb of Childeric (King of the Franks, died A.D. 481). Absolute evidence as to nail shoes in the ninth and tenth centuries is comparatively plentiful, not the least important being the *Tactica Imperatoris Leonis* of Emperor Leo VI., dating from the ninth century. There is no reason to doubt that the Arabs of the Hejira (A.D. 622) shod their horses with iron; while, according to the *Chroniques de Saint-Denis*, Charlemagne was capable of breaking with his hands an 'iron' shoe belonging to his horse. In the nature of things it was not likely that shoeing with iron was at all common in the early part of the Middle Ages. William the Conqueror is believed to have introduced the art into Britain. For centuries the art of the shoesmith ranked with that of the scholar and bard in England and France, and not only noblemen, bishops, and squires, but even kings practiced the craft. In fact, according to Solleysel (c.1665), a knowledge of the art was a necessity for all persons of high estate, which explains the fact that many of the oldest families of England, France, and Poland have to-day a horseshoe device in their insignia. Occasionally shoeing took the form of extravagance, as when Poppæa, the wife of Nero, had her mules shod with shoes of gold—a fantastic fashion often recorded in history. As late as 1616 the English Ambassador to France entered Paris riding a horse whose silver shoes were so lightly fastened on that when he came to a spot where "eminent men or beautiful women were standing" he caused his steed to prance, and so cast its shoes, which were scrambled for by the crowd. His 'argentier,' wearing a rich livery, replaced the shoes with similar ones just as loosely fastened.


NORMAL FOOT READY FOR SHOEING.
Illustration of healthy frog and bars.

Modern Horseshoeing. The advanced farriery of to-day owes its excellence to modern veterinary science; so that there is no longer excuse for the ignorance which in comparatively recent times was universal, and which even to-day is prevalent to some extent. Notwithstanding State examinations and increased general knowledge, it is admitted that the horse's feet are unnecessarily mutilated by wholesale cutting, regardless of the anatomy, physiology, and economic relations of the parts of the hoof. This practice is followed solely on the score of tradition; and, great as the financial loss has been, it is little compared to the agony which horses have endured. The frog of the hoof is designed to act as a cushion which by its elasticity protects the other structural parts from jar and harmful concussion. Normally, the resilience of the frog helps to maintain the natural expansion of the hoof; a vital function which is entirely destroyed by the too common use of the 'drawing-knife,' and which converts what should be a means of protection into a source of danger. The further fault of paring down the sole, until the living structures within are almost exposed through the soft, moist, half-formed horn, which is all that the paring-knife has left, is very severely condemned. Bad farriery and shoeing are frequently guilty of still further maiming the horse in endeavoring to improve upon nature by removing the bars, or 'opening' the heels; such a foot becomes predisposed to contraction of the heels. In the effort to use a shoe too small for the foot the rasp is brought into play, and the foot made to fit the shoe. It is generally conceded that the outside or horny wall of the hoof, together with that portion of the sole which is in immediate contact with it, and upon which the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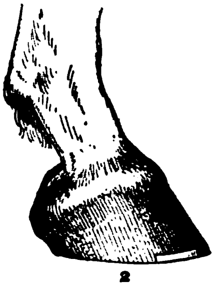
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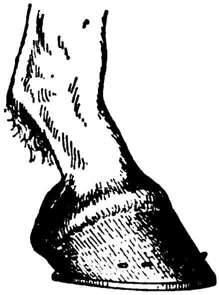
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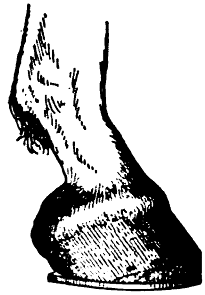
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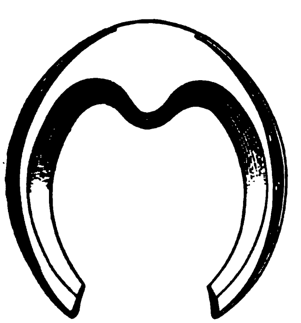
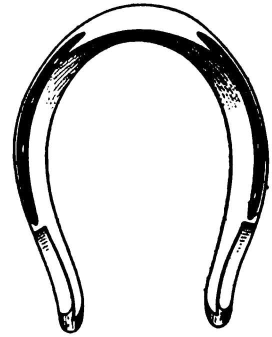
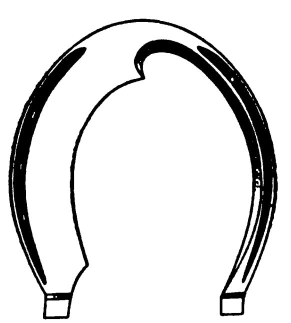
FIG. 1. FOOT PREPARED FOR CHARLIER TIP.
FIG. 2. THE CHARLIER TIP.
FIG. 3. RIGHT FITTING SHOE.
FIG. 4. WRONG FITTING.


TOE WEIGHT SHOE.


SHOE TO BALANCE ACTION; HIND FEET.


SIDE WEIGHT SHOE FOR HIND FEET.

shoe should rest, are the only portions which require paring, and then not with the knife, but with the rasp. There is considerable difference of opinion among authorities with regard to the various details of shoeing, but all are agreed on the barbarity as well as uselessness of the frog and sole mutilation already described.

The shoe should be as light in weight as the circumstances will permit, the determining factors being the weight of the horse and the nature of the work it must do. The old adage that 'an ounce at the toe means a pound at the withers' is undoubtedly true in essence, but a still greater handicap is the increased concussion inseparable from progression. It is not true that a heavy shoe necessarily wears longer than a light one, while it is well known that a light shoe is just as effective as a heavy one in performing its legitimate mission of preventing undue wear of the walls of the hoof. The shoe should be made to conform exactly to the natural tread of the foot, and should be permitted on no account to remain on for too long a time, as the truncated cone of the hoof, which has its base downward, constantly increases in circumference, so that in time the shoe becomes too small and a source of pain to the horse. Common errors in shoeing are the employment of too many and too heavy nails, and the driving of them too high up into the walls. If shoes could be securely attached and safely worn without the use of nails much would be gained; but although numerous alternative devices have been put on the market, the best of which fastens the shoe by means of metal bands or stubs, none has been found to be generally satisfactory.

Winter shoeing demands that the shoe be capable of affording foothold as well as protection against undue wear, and for this purpose shoes are made fashioned with toe and heel calks, or calkins. Care is necessary to avoid making the calks any larger than is absolutely necessary, or else serious injury may be done to the horse. The art of shoeing for specific purposes is of American origin, and is a result of the development of the trotter. At first, designed to influence speed or action, shoes are now made to remedy defects, natural or acquired, due to faulty conformation or bad habits. Shoes for racers, trotters, and speed horses generally have an adaptable variety of form and principle. Among those designed to remedy defects in the horse most generally employed in the business and pleasure of the community at large may be mentioned the scoop-toed or roller-motion shoe for the fore feet and a shoe for the hind feet, designed to do away with 'forging' or 'clicking.' The scooped or rolled toe hastens the action of the fore legs, and enables them to avoid being struck by the hind foot; while the lengthening of the branches of the hind shoes, by increasing the ground surface, retards the 'breaking over' of the hind foot. A common practice to 'open' the action is to increase the outside web of the hind shoes. The faults of 'dishing' or 'paddling' are remedied by similar devices. The principal diseases common to neglected or faulty shoeing will be found treated under HORSE, or under their own title throughout the book.

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HORSESHOES, LUCK OF. See SUPERSTITION.

HORSESHOE-SNAKE (so called from its markings). A large, handsomely marked colubrine serpent (*Zamenis hippocrepis*) of the Mediterranean region, closely allied to the American blacksnake.

HORSETAIL (so called from the shape). A common name given to species of Equisetum ('scouring rush'), a genus which represents one of the three great divisions of fern plants (pteridophytes). See EQUISETUM.

HORS'FORD, EBEN NORTON (1818-93). An American chemist, born at Moscow, N. Y. He graduated as a civil engineer at the Rensselaer Polytechnic Institute in 1838, and was engaged during the following year on the geological survey of New York State. In 1840 he became professor in the Albany Female Academy. In 1844 he went to Germany and studied chemistry for two years under Liebig. From 1847 to 1863 he held the Rumford professorship of applied science at Harvard College. He endowed the library and laboratory of Wellesley College, and was one of the first professors in the Lawrence Scientific School. He left Harvard to engage in chemical manufactures. He was interested in antiquarian research, and was generally credited at one time with having identified the site of the supposed Norse settlement Norumbega (q.v.) as being on the Charles River near Boston. His dictionary of the Iroquois and Algonquin languages is a valuable contribution to Indian philology. He published *The Discovery of Norumbega* (1892).

HORSLEY, hôrs'lĭ, CHARLES EDWARD (1822-76). An English organist, pianist, and musical composer, born in London. A pupil of his father, William Horsley, of Moscheles, Hauptmann, and Mendelssohn, and a friend of Spohr, he began musical composition while studying in Germany, and an overture by him was rendered at Cassel in 1845. He was organist of Saint John's, Notting Hill, London (1853-57), but went to Australia in 1868, and thence to America in 1876, where he died. He was the author of three oratorios: *David* (1846); *Joseph* (1849); and *Gideon* (1860); besides music for Milton's *Comus* (1860); *Euterpe*, an ode for the inauguration of Melbourne City Hall (1870); and a *Text-Book of Harmony* (1876), published after his death.

HORSLEY, JOHN CALLCOTT (1817-1903). An English genre painter. He was born at Brompton, and studied at the Royal Academy's schools. Later he was one of the head masters at the School of Design, Somerset House. He received several prizes for his cartoons at the Westminster Hall competition in 1843, and painted al fresco the "Spirit of Prayer," in the House of Lords, and "Satan Touched by Ithuriel's Spear," in the Poets' Hall of the Palace of Westminster. Some of his other works are "Malvolio the Sun," "L'Allegro," and "Il Penseroso," "Under the Mistletoe," "Caught Napping," "Scenes from Don Quixote," "Healing Mercies of Christ," "Wedding Rings," and "Hide and Seek." The coloring of his pictures is good, but their genre motives are often strained. He was elected to the Royal Academy in 1866.

HORSLEY, Samuel (1733-1806). An English prelate. He was born at Saint Martin's-Place, London, September 15, 1733. He was educated at Westminster School and Trinity Hall, Cambridge. In 1758 he became curate to his father, then rector of Newington, and the next year succeeded to the rectory, a living which he held for thirty-four years, though he also enjoyed in the interval many other preferments. He was a scientist as well as a theologian, and first attracted attention by scientific writings. He is chiefly remembered, however, for his controversy with Dr. Joseph Priestley, growing out of the publication of the latter's *History of the Corruptions of Christianity* (1782), among which corruptions was included the orthodox doctrine of Christ's uncreated divinity. Horsley reviewed the work with great severity in his charge delivered to the clergy of the Archdeaconry of Saint Albans, May 22, 1783. Priestley replied the same year in a publication entitled *Letters to Dr. Horsley in Answer to His Animadversions*, etc. In 1784 Horsley retorted in seventeen *Letters from the Archdeacon of Saint Albans in Reply to Dr. Priestley*, etc. These were, in return, met by a new series from Priestley. After a silence of eighteen months, Horsley again replied in his *Remarks on Dr. Priestley's Second Letters*, etc., and in 1789 collected and published the whole that he had written on the subject. His services were rewarded with the Bishopric of Saint David's in 1788, whence he was translated to the Bishopric of Rochester in 1793, then to Saint Asaph's in 1802. He died at Brighton, October 4, 1806. His collected theological works were published (London, 1845).

HORSLEY, Victor Alexander Haden (1857 —). An English surgeon and neurologist. He studied medicine in London, and in 1881 received the gold medal in surgery from the University School. He has been president of the Medical Defense Union, and is Fellow of the Royal Medical Chirurgical Society; member of the Pathological, Clinical, and Physiological societies; corresponding member of the Biological Society of Paris, and of the Medical Society of Budapest; honorary fellow of the American Surgical Society and of the American Neurological Society; surgeon to the University College Hospital; professor of pathology in University College; surgeon to the National Hospital for paralyzed and epileptic; and secretary of the Government Commission on Hydrophobia. The results of his researches in cerebral localization are of the greatest value, and have made him eminent. He is the author of a *Report on Septic Bacteria* (1882); articles in Heath's *Dictionary of Surgery* and Quain's *Dictionary of Medicine* (1883); *Surgical Reports of University College Hospital* (1882 and 1883); "Functions of the Marginal Convolutions," in *Proceedings of the Royal Society* (1884) and *Philosophical Transactions of the Royal Society* (1888); "Analysis of Movements Produced by Stimulating Ferrier's Cortical Arm Centre" (ib., 1886-89); "On the Thyroid and Pituitary Bodies," in *British Medical Journal* (1886); *The Pathology of Epilepsy and Canine Chorea* (1885-86); "On the Functions of the Thyroid Gland," in *British Medical Journal* (1885); *Brain Surgery* (1887); "On Localization of Disease in Cerebrum," in *International Journal of the Medical Sciences* (1887); *Hydrophobia and Its Treatment* (1888); *An Experimental Investigation of the Central Motor Innervation of the Larynx*, with Felix Semon (1890); *The Structure and Functions of the Brain and Spinal Cord* (1892); with Boyce, *Preliminary Report on Œdema* (1893); with Schäfer, *Experiments upon the Functions of the Cerebral Cortex* (1888).

HORSLEY, William (1774-1858). An English organist and composer, born in London. He early began the composition of glees, in which he did his best work, and his first appointment as organist was to Ely Chapel, Holborn (1794). Three years afterwards he became assistant, son-in-law, and successor (1802) to Dr. Callcott at the Female Orphan Asylum, having by that time received the degree of Mus. Bac. from Oxford. He was also organist at Belgrave Chapel, Grosvenor Place (1812-37), and afterwards at the Charterhouse (1838). He was one of the founders of the Philharmonic Society (1813), and belonged to several other musical organizations. He will long be remembered for his anthem, *When Israel Came Out of Egypt* (1800), *Celia's Arbor* (1807), and for five collections of such glees as *See the Chariot at Hand*, *Mine be a Cot*, *Cold is Cadwallo's Tongue*, and *Oh, Nightingale*, published 1801-27. He wrote also pianoforte pieces, hymn and psalm tunes, and several works on harmony, such as *An Explanation of Musical Intervals of the Major and Minor Scales* (1825).

HORT, Fenton John Anthony (1828-92). A distinguished English theologian. He was born of English ancestry at Leopardstown, near Dublin, Ireland, April 23, 1828, was educated at Rugby and Cambridge, fellow of Trinity College, Cambridge, 1852-57; vicar of Saint Ippolyts, Hertfordshire, 1857-72; lecturer and professor at Cambridge from 1872 to his death, November 30, 1892. Hort was one of the most learned men of the nineteenth century. He distinguished himself not only by his marvelous attainments in classical and patristic literature, but by an extensive acquaintance with botany and mathematics. Nevertheless he was always reluctant to publish the results of his studies. The great monument of his life-work is the Westcott-Hort Greek Testament (1881). For over thirty years he made the Greek text of the New Testament his chief study, and at his death was one of the first authorities in the world on this subject. To him textual criticism owes the clear and convincing exhibition of the principles of genealogical evidence presented in the *Introduction to the New Testament in Greek* (1881). Since his death many of his lectures have been edited and published. Consult his *Life and Letters*, by his son, A. J. Hort (New York, 1896).

HORTA, hôr'tȧ, *Port. pron.* ōr'tȧ. A seaport of the island of Fayal, Azores, and capital of the District of Horta. It has a safe and good harbor. Population, in 1900, 6734.

HORTENSE EUGÉNIE DE BEAUHARNAIS, ôr'täNs' ĕ'zhȧ'nĕ' *de* bô'är'nȧ'. See Bonaparte.

HORTENSIO, hôr-tĕn'shĭ-ō. A suitor of Bianca, the younger sister of Katharine, in Shakespeare's *Taming of the Shrew*.

HORTENSIUS, hôr-tĕn'shĭ-ŭs, QUINTUS (c.350-286 B.C.). A Roman legislator. His *Lex Hortensia,* passed in his dictatorship (286), decreed that the laws passed by the plebs were binding on the whole people, and brought to an end the struggle between plebeians and patricians. Hortensius died while he was dictator.

HORTENSIUS, QUINTUS (B.C. 114-50). A Roman advocate and orator, a contemporary of Cicero, with whom he was personally on good terms, though opposed in politics, and often matched against him in legal contests. Hortensius had already obtained a name as an orator before he was twenty, and he passed through the several grades of the public service until he obtained the consulship in B.C. 69; afterwards he withdrew largely from politics and devoted himself to pleading in the courts. He was an effective, though florid, orator, but often showed himself unscrupulous in attaining his ends. None of his orations or writings have been preserved.

HORTICULTURAL SOCIETIES. Associations for the encouragement of gardening. They are now numerous in almost all civilized countries, but seem to derive their origin only from the beginning of the nineteenth century, when the London Horticultural Society was formed. The society obtained a charter in 1808. The Experimental Garden of the society, the first of its kind, was established in 1817, and was removed to its present situation at Chiswick in 1822. The progress of the society was very rapid, and its usefulness is still very great. Societies of the same kind soon began to spring up in Germany and other parts of the Continent of Europe, and now exist in almost all parts of the civilized world. In the United States there are about five hundred horticultural societies. The New York Horticultural Society, organized in 1818, and now extinct, was the first to come into existence. The American Pomological Society, established in 1850, is now one of the strongest organizations of its kind in the world. The purpose of these societies is education and the development of interest along horticultural lines.

HORTICULTURE (from Lat. *hortus*, garden + *cultura*, cultivation, from *colere*, to cultivate). The branch of general agriculture that deals with the raising of fruits, vegetables, and ornamental plants. On the one hand, horticulture merges into agriculture in its restricted sense, i.e. the raising of cereal, forage, textile, and root crops; on the other into landscape gardening, which is really a fine art. To illustrate, peas raised to be used as an esculent are classed as a horticultural crop, but if grown for the dry seed they are considered an agricultural crop; the names 'garden peas' and 'field peas' sufficiently indicate the distinction. Again, plants raised for their intrinsic ornamental merit are properly subjects of horticulture (see FLORICULTURE and FORESTRY); but if their primary use is as units in a general landscape effect, they are subjects of landscape gardening (q.v.). While the development of agriculture, in the restricted sense of the term, springs from sheer necessity, that of horticulture, which serves to gratify the sense of beauty and the desire for comfort, naturally implies a state of communal or national ease, of thrift, and even luxury. This fact is emphasized by the time at which horticulture becomes industrially important in a nation's history. For it attains commercial importance in a community only when the pioneer days have passed, when the rugged soil has been educated by the practices of general farming, and prosperity seeks new channels by diversification of interests.

But horticulture is really much less simple than may be inferred from the ordinary definition of its scope. Problems of plant physiology, of breeding and variation of plants under domestication, of the operation within its domain of natural laws in opposition or in conjunction, of the life histories of innumerable organisms, such as insects, mites, bacteria, and microscopic fungi, are closely connected with the ordinary problems of horticulture proper, and render it an art of great complexity. Further, with its growth, which, especially in America, has been phenomenal, many industries, such as the nursery and the seed industries; the manufacture of tools and implements; of artificial fertilizers; baskets, barrels, tins, jars, and other packages; the preparation of canned, evaporated, or otherwise preserved fruits and vegetables; storage by refrigeration; the transportation of all materials for manufacture and of the finished product—these and other industries have either sprung into existence or have been vastly increased in magnitude with the development of horticulture. Moreover, since each of its branches may be carried on in the open air or under glass by specialists; since each species, and in many instances each variety, cultivated, demands some special knowledge of its peculiar needs; since a total of fully 25,000 plants, some of which have thousands of varieties, are cultivated for use or ornament; since climates, soils, and other conditions differ as widely as do details of raising; since markets are as whimsical in their demands as persons; and finally, since improvements and discoveries in plants, varieties, methods of culture, marketing, etc., are annually reported, it is apparent that the realm of horticulture is exceedingly broad.

The main divisions of horticulture are floriculture, or flower-growing; pomology, or fruit-growing; and olericulture, or vegetable-growing. Each of these divisions may be further subdivided into amateur and commercial branches, the former dealing with personal ideals, the latter with commercial demands. Of course, these two are blended to some extent, and it should be noted that examples of the former are annually increasing to the no small advantage of the community, the nation, and the world.

The ancient methods of gardening were so crude, the means of disposal so limited, and the areas devoted to horticultural industry, if such it might be called, so small that the term horticulture, as now understood, if applied to that early gardening would be a misnomer. Not until within the past two hundred years was the term more than occasionally employed, and only during the past century did it come into general use. As proof of the interest taken in horticultural matters during the nineteenth century may be mentioned the development in America of a horticultural literature. In 1800 there were very few agricultural works that devoted more than a few chapters or even pages to fruits and vegetables. The first American horticultural book was published in 1804. Not only was there at the time no periodical devoted wholly to horticulture, but there was none that had even a horticultural department. Not until 1821 did a horticultural column appear in the *Massachusetts Agricultural Repository*, the first agricultural journal printed in America. During the nineteenth century fully 600 books were published and 500 horticultural journals were started, of which about 40 were in circulation in 1900. The tendency of recent horticultural literature has been to substitute for the long series of specific rules formerly popular a set of general principles, which, if thoroughly grasped, might enable the reader to judge as to what working method may best suit any given case under any combination of local conditions. Outside of North America, during the past century, the development of horticulture, though less marked, has been, nevertheless, very remarkable as compared with previous centuries.

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For somewhat detailed discussions of special horticultural topics, see: FRUITS, CULTIVATED; HARVEST AND HARVESTING; FUNGI, ECONOMIC; DISEASES OF PLANTS; FUNGICIDE; INSECTICIDE; ELECTROCULTURE OF PLANTS; PLANT-BREEDING; POMOLOGY; HORTICULTURAL SOCIETIES; IRRIGATION; MANURES AND MANURING; NITRIFICATION; WINDBREAK; GRAFTING; also AGRICULTURE, and the articles on various plants grown for use or ornament.

HOR′TON, SAMUEL DANA (1844-95). An American publicist, born in Pomeroy, Ohio. He graduated at Harvard College in 1864, and at the Harvard Law School in 1868; studied in Berlin from 1869 till 1870, and was admitted to the bar in Ohio in 1871, practiced in Cincinnati until 1874, and afterwards in Pomeroy. He soon became interested in questions of coinage, was among the first to argue the advantage of the establishment of an international ratio between silver and gold, and was the author of books on coinage and currency, characterized by careful historical research. In 1878 he served as secretary of the International Monetary Conference assembled in Paris, and was a delegate to the second conference held there in 1881. His most important writings are: *The Monetary Situation: An Address* (1878); *Silver and Gold, Their Relation to the Problem of Resumption* (1880); *The Silver Pound and England's Monetary Policy Since the Restoration*, together with *The History of the Guinea* (1887); *Silver in Europe* (1890).

HORTUS SICCUS. See HERBARIUM.

HORUK, hŏ′rụk. The name of a Greek pirate, also called Barbarossa (q.v.).

HO′RUS (Lat., from Gk. Ὧρος, Egyptian *Hôr*). An Egyptian deity. His name *Hôr* (*u*) is by some scholars explained as meaning 'the superior, highest,' but this is an improbable etymology, not more probable, perhaps, than the earlier comparison with Hebrew *ôr*, 'light,' which is generally ridiculed at present. It is questionable where Horus had his original local cult; usually Edfu, where a large temple is still standing, is considered to have been the locality, although the god was worshiped at a great many other places. He was patron of Upper Egypt. On the very earliest monuments we find Horus as the chief god and type of the King; from the first the hawk is his symbol, and there are allusions to his antagonism to Set, so that the later theological ideas seem to be traceable to the time of the First Dynasty. The original dominating position of Horus within the pantheon is shown by the fact that his hawk stands as hieroglyph for 'god' in general. He personifies the sun, originally thought to fly over the sky in form of a hawk, and is usually represented as a young warrior with the head of a hawk, wearing the crown of Egypt. More specially he personifies the young sun, rising victoriously in the morning out of the hostile darkness. Therefore, he is connected with Osiris, the sun dying in the west, and as his son he takes vengeance for his father on the powers of darkness. More rarely he is called the son of Rē, the midday sun. He is frequently called a posthumous son of Osiris; his mother, Isis, is even said to have formed him from the mutilated members of her murdered husband. Rising gloriously, Horus begins the fight with Set-Typhon, his wicked uncle, every morning—although later (partly euhemeristic) views consider the great fight between the gods as a single event, occurring at the beginning of the world. Avenging his murdered father, Horus overthrows and emasculates Set; but he loses one eye in the contest. Possibly this refers to the moon, which loses its light every month; or else the sun may be the single eye in the face of the god, i.e. the sky. The wounded eye is healed by the moon-god (Dhouti, Thoth), which means that the second eye appears in the night. The blood of the wounded eye drips down and creates plants, animals, and all good and useful things on earth. It is curious to note how Horus is differentiated in regard to his various functions and phases. We find, for example, Harpocrates (Horus as a child) distinguished from Haroëris (the adult Horus); Harondotes (Egyptian: Har-nez-iotef) 'the avenger of his father;' Horus in Khemnis, as a babe hidden by his mother in the marshes of the Delta from the persecutions of Set; Harmachis (q.v.); 'Horus uniting both lands;' and various other forms became localized and had their special cults. Many details of the Horus myth are obscure; for example, the legend that he once cut off the head of his mother, which may have been borrowed from an Asiatic cosmogonic myth. The later theology explained this story by the statement that Isis had set free the wicked Set after Horus had delivered him to her in fetters, and that Horis mutilated her in his indignation at her act. The moon-god (see above) replaced the head of Isis by a cow's head. The story of the fight against Set-Typhon is told with a great many variations, and the wicked adversary and his many helpers resist Horus in many forms and at many places. Later, the serpent Apap, as the personification of night and the hostile ocean, became confounded with Set (q.v.). The later Egyptians, under Greek influence, made strange attempts to harmonize these hundreds of different, contradictory myths. (See especially Plutarch's *De Iside et Osiride*, and the accounts given by Diodorus.) Like Osiris, Horus was explained as typifying everything good in nature, although the solar meaning of most of the mythological facts was too manifest to be entirely overlooked. The planets Mars, Jupiter, and Saturn were also considered as manifestations of Horus ('the red Horus,' 'the brilliant Horus,' 'Horus, the bull'). In the mythical accounts of the early history of Egypt, Horus was counted as the last of the divine rulers of the land. The principal temples of Horus were at Letopolis, in Lower Egypt, at Kus (Apollinopolis Narva), and at Edfu (Apollinopolis Magna—the Greeks identified Horus with their Apollo); he was worshiped also at Ombos, Denderah (Tentyra), Damanhur (Hermopolis Parva), etc. In Imperial Rome he became as popular as Isis and the other members of the Osirian family. See Plate of EGYPTIAN DEITIES, in the article EGYPT.

HORUS. An Egyptian name, usually understood as that given by Manetho to the last King of the Eighteenth Dynasty, the Har-em-heb of the hieroglyphic inscriptions. He had been Prime Minister of several of his predecessors, and by marrying a princess he ascended the throne somewhat after B.C. 1380. The duration of his reign is uncertain; five years are assigned to him by Manetho, while according to the monuments he reigned for twenty-one years at least, though this may be due to an artificial reckoning. His principal buildings are the pylons in the temple at Karnak. Of military achievements only an expedition against the negroes of the Sudan is mentioned in his rock-hewn temple at Silsileh. He completed the religious reaction against the reformation introduced by Amenophis IV. Harmais, of whom Herodotus has preserved some strange popular tales, is the same person. In other places, however, Manetho gives the name Horus to the heretic King Amenophis IV. (q.v.).

HORVÁTH, hôr′văt, MIHÁLY (1809-78). An Hungarian ecclesiastic, statesman, and historian, born at Szentes, in the County of Csongrád. He entered the priesthood in 1830, and before 1841 held a number of pastorates. His liberal ideas led him to abandon, temporarily, his priestly calling, and he became, in 1844, professor of the Hungarian language and literature at Vienna. In 1848 he was made Bishop of Csanád, and in the following year, upon the declaration of Hungarian independence, became Minister of Public Education and Worship. After the collapse of the revolutionary movement he fled the country, and lived abroad under sentence of death, returning only in 1867. He reëntered politics, and until his death was a member of the Lower House of the Diet, voting with the Deák party. His principal works are: *History of the Hungarians to 1823* (3d ed., 8 vols., Budapest, 1873); *Twenty-five Years of Hungarian History, 1823-48* (2d ed., Budapest, 1868); *History of the War of Independence in Hungary, 1848-49* (2d ed., Budapest, 1872).

HORWICH, hŏr′ĭj. A town in Lancashire, England, five miles west-northwest of Bolton (Map: England, D 3). Its industries comprise railway works, paper-making, cotton manufactures, bleaching works, and coal-mining. It owns its water-supply. Population, in 1891, 12,850; in 1901, 15,100.

HOSACK, hŏs′ak, DAVID (1769-1835). An American scientist, born in New York. He graduated at Princeton in 1789; studied medicine in Philadelphia and afterwards in Europe, and was chosen professor of botany in Columbia College in 1795. In 1807 he became professor of materia medica and of midwifery in the College of Physicians and Surgeons, then newly founded, and subsequently of the theory and practice of medicine, and of obstetrics and the diseases of women and children. He was the founder of the first botanic garden in the United States. He was connected with Drs. Mott, Macneven, and Francis in organizing the medical department of Rutgers College, at New Brunswick, N. J., and in New York City he held various medical positions in asylums and hospitals. He was one of the founders, and for twelve years president of the New York Historical Society, and was a fellow of the Royal Society of Great Britain.

HOSANNA, hō-zăn′nȧ. The cry with which Jesus was greeted at His last entry into Jerusalem (Matt. xxi. 9; Mark xi. 9; John xii. 13), and which until recently was generally considered to be identical with the Hebrew expression *hoshia-na,* 'save now,' occurring in Psalm cxviii., abbreviated to *hosha-na.* This expression occurs as part of the Psalter used at the Feast of Tabernacles. When this word was said the boughs were waved. Gradually the boughs themselves came to be called hosannas, and the day on which the hosanna prayer was said seven times came to be called 'day of the great hosanna.' But in the New Testament passages 'hosanna' is used as an acclamation almost as 'hail!' in English, and it is not easy to account for this transition, especially as Jesus' entry took place at the Passover and not at the Tabernacles season, so that there would hardly be any occasion to introduce 'hosanna.' In view of this, it is possible that 'hosanna' in the Old Testament represents originally a different word, perhaps the Aramaic *ushna,* 'strength'—which has subsequently become confused with the Old Testament 'hosha-na.' Consult: the discussion in Dalman, *Die Worte Jesu,* vol. i. (Leipzig, 1898); id., *Grammatik des jüdisch-palästinischen Aramäisch,* p. 198 (ib., 1894).

HOSEA, hô-zē′ȧ (Heb. *Hôsē a,* deliverance). One of the prophets, whose discourses, forming the Book of Hosea, come first in the group of minor prophets. Of his life we know nothing except what may be inferred from references in the discourses. His father's name is Beeri (Hos. i.), and his home is in the Kingdom of Israel. In the first three chapters he uses as an illustration a strange incident in his own life. He had taken to wife a woman, Gomer, the daughter of Diblaim, who bore him three children, but who turned out to be a faithless and worthless woman. This personal experience, the substantial reality of which there is no reason to question, appears to the prophet as typifying the faithlessness of the people of Yahweh to their God. It is not necessary to go so far as to suppose that the prophet actually gave his children the symbolical names Jezreel, Lo-ruhamah ('not beloved'), Lo-ammi ('not my people'), as indicated in chapter i. This feature is clearly allegorical, but Hosea's divorce from his wife and his subsequent reunion with her (chapter iii., unless, indeed, another wife is meant) are probably incidents in his own life. According to the present heading of the book, his activity extended over the reigns of Uzziah, Jotham, Ahaz, and

Hezekiah of Judah (about 790-690 B.C.) and the reign of Jeroboam II. of Israel (c.782-743 B.C.). Scholars think that these indications cannot be correct, the former being too long a period, and the latter too short. Internal evidence points to the beginning of Hosea's activity as represented in his discourses at some time before the death of Jeroboam and ending before the attack of Tiglath-Pileser on the northern kingdom in B.C. 734. Hosea addresses himself chiefly to Israel, the northern kingdom, and the burden of his message is the people's infidelity toward Yahweh as exemplified by their adoption of foreign rites, by political alliances that subjected the people to foreign influences, and by the general neglect of moral standards in public and private life. These conditions were brought about by the energetic political policy inaugurated by the dynasties of Ahab and Jehu, and the prophet fairly exhausts the vocabulary in his denunciation of this policy and in predicting the dire destruction, not only of the dynasty, but of the people. The book may be divided into two parts: (1) Chapters i.-iii., detailing his personal experience of marriage to a faithless woman, and the application of the experience to conditions existing in the northern kingdom; (2) chapters iv.-xiv., in which (a) the Canaanite features in the Hebrew cult are denounced and the attendant moral degradation of the people; (b) the misrule of the Kings, the riotous life of the Court, and the fondness for foreign alliances are pictured in vivid colors. Scholars are agreed in recognizing a number of later additions and interpolations to the original text of the discourses. In these additions (1) references are supplied to the Kingdom of Judah with which it appeared the prophet did not concern himself at all; and (2) the gloomy outlook is modified by holding out the hope that a remnant at least, uncontaminated by the prevailing religious and political conditions, will escape the awful doom and form the nucleus for the reconstitution of the people on the basis of true Yahweh worship and with obedience to Yahweh's laws as the corner-stone. Consult: the commentaries mentioned in the article MINOR PROPHETS; Cheyne, in the *Cambridge Bible for Schools and Colleges* (Cambridge, 1889); Valeton, *Amos and Hosea* (London, 1894); W. R. Smith, *The Prophets of Israel* (London, 1895).

HOSEA BIGLOW. The fictitious signer of a number of Lowell's *Biglow Papers* (q.v.).

HOSEMANN, hō'ze-män, ANDR. See OSIANDER.

HOSEMANN, THEODOR (1807-75). A German painter and illustrator, born at Brandenburg. He studied lithography under Arnz and Winckelmann, and then was a pupil of Cornelius and Schadow. Afterwards he went to Berlin, and in 1857 was made professor at the Academy. His works include genre pictures in oil and water-color, such as "Shoemakers' Apprentices" and "Peasant Girls and Boys," and illustrations for *Baron Münchhausen*, *The Mysteries of Paris*, and Andersen's *Fairy Tales*.

HOSIERY (from *hose*, AS., OHG. *hosa*, Ger. *Hose*, hose, stockings). In its most limited sense, this term refers to the manufacture of stockings (hose); but in its more general application it comprises all knitted goods, either made by hand or by machinery. The use of stockings originated in the cold countries of the north of Europe, and probably the first were made of skins, and subsequently of cloth; they were also, until a comparatively late period, made all in one piece with the trousers, constituting trunk-hose. These garments were separated, and the art of knitting was invented, it is supposed in Scotland, about the commencement of the sixteenth century. Knitted stockings found their way to France from Scotland, and led to the establishment of a guild of stocking-knitters, who chose for their patron saint Saint Fiacre of Scotland. In 1589 William Lee, of Woodbridge, Nottinghamshire, entirely altered the hosiery trade, by inventing the knitting-frame. See KNITTING.

HOSIUS, hō'shĭ-ŭs (c.256-c.358). Bishop of Cordova. He became bishop about 295, and retained the office till his death about 358. Having suffered persecution under Maximian, he was honored for his steadfast faith. The Emperor Constantine was strongly attached to him, and it may be owed his conversion to him. In 324 he sent him to Alexandria to mediate between the Bishop of that city and Arius, as well as to settle the dispute concerning the observance of Easter. In the following year the Council of Nicæa was called for the purpose of considering both subjects, and Hosius was the president, or, at least, one of its presiding officers. At the close of the council he drew up, or, as some say, announced the decree, signed it first, and prevailed on the Emperor to sanction it. He was president of the Council of Sardica, called in 343-344 by Constantius and Constans at the desire of Athanasius. In 355 Constantius requested him to join in condemning Athanasius, but instead of doing so, Hosius defended him. Having persisted in this course a second, and even a third time, he was, at the close of the year, banished by the Emperor. Two years afterwards he was summoned to attend the Council of Sirmium, where, worn out with extreme age and hardship, he was prevailed on to sign a document favoring Arianism, yet he steadfastly refused to condemn Athanasius. He was then allowed to return to his home and office. Consult Gams, *Die Kirchengeschichte von Spanien* (Regensburg, 1864).

HOS'MER, HARRIET (1830—). An American sculptor. She was born in Watertown, Mass., and received her education in Lenox. She was instructed in modeling under Stevenson at Boston, but later studied anatomy in the Saint Louis Medical College. Her real instruction in art was received in the studio of John Gibson (q.v.) at Rome, where she has chiefly resided. In his studio she modeled her original heads "Daphne" and "Medusa," executed for Samuel Appleton, of Boston; "Beatrice Cenci," in the public library of Saint Louis; and "Œnone" (1855), her first full-size figure. Her spirited and original statue of "Puck" was esteemed so successful that copies were ordered, among others, by the Prince of Wales and the Duke of Hamilton. Her most ambitious work is a colossal statue of "Zenobia in Chains," completed in 1859. Her bronze statue of Thomas H. Benton is in Lafayette Park, Saint Louis. The "Sleeping Faun," exhibited in Paris in 1867, is one of her best works. Its companion is called "A Waking Faun." The fountain in Central Park, New York, and the heroic statue of Queen Isabella of Castile, unveiled in San Francisco in 1894, are by her, as are also the "Queen of

Naples" and the "Heroine of Gaeta." Her latest works are two fountains in private possession in England. Miss Hosmer's art is classic in tendency, like that of her master, Gibson. She has also invented technical processes of note in connection with her art.

HOSMER, James Kendall (1834—). An American author, born in Northfield, Mass., and educated at Harvard. He left the Unitarian church at Deerfield, of which he was pastor, to go to the Civil War as a private soldier, and upon his return took a professorship in Antioch College. Thence he went to the University of Missouri, taught English and German literature for two years, and in 1874 was appointed professor of the same branches at the Washington University, Saint Louis, a post he retained until his appointment as librarian of the Minneapolis Public Library in 1892. His published writings are: *Color Guard* (1864); *Thinking Bayonet* (1865); *Short History of German Literature* (1878); *Memorial of G. W. Hosmer, D.D.* (1882); *Story of the Jews* (1885); *Life of Samuel Adams,* in the "American Statesmen Series" (1885); *Life of Sir Henry Vane* (1888); *Short History of Anglo-Saxon Freedom* (1890); *How Thankful Was Bewitched* (1894); and *Life of Thomas Hutchinson* (1896).

HOSPICE. See Inn.

HOSPIN'IAN, Rudolf (1547-1626). A Swiss Reformed polemical writer. He was born in the Canton of Zürich. After studying there he went to Marburg and Heidelberg, and on his return in 1568 combined the position of preacher with that of school-teacher. From 1576 to 1595 he was head of the famous Karolinenschule attached to the Great Minster. Meanwhile he pursued distinctive studies and entered the lists as a doughty champion of the Reformed Church against Roman Catholics and Lutherans. Bellarmine wrote against him on the side of Rome and Hutten on the side of Luther. His fellow townsmen highly honored him. In 1588 he was made an archdeacon of the Great Minster, and in 1594 pastor of the Fraumünster Church. He died in Zürich, March 11, 1626. His works were collected under the editorship of J. H. Heideffer, and published in seven folio volumes (1681). The latest of his writings was *Historia Jesuitica* (1619), trans., *The Jesuits' Manner of Consecrating Persons and Weapons Employed for the Murdering of Kings and Princes by Them Accounted Heretics* (Dublin, 1681).

HOSPITAL (from OF. *hospital,* Fr. *hôpital,* from ML. *hospitale,* inn, from Lat. *hospitalis,* relating to a guest or host, from *hospes,* guest, host). A place used for the shelter and treatment of the sick or wounded. In the earlier days, orphans and helpless children were brought up in institutions called hospitals. Leper hospitals were established in early times and were called 'spitals' or *hospitia.*

Hospitals were founded in very early times. India, Persia, and Arabia had hospitals supported by their kings and rulers before the Christian Era. As far back as the earliest period of Greek history the sick are said to have been treated in the Temple of Æsculapius at Epidaurus. In the early Jewish period a house for the reception of the sick was called Beth Holem. Such an institution was Beth Saida, mentioned in the New Testament. These hospitals seem to have been wooden huts. In ancient Egypt hospitals were unknown, the sick being tended at home or in temples. Plato says that the Greeks, on the other hand, maintained shelter houses for the sick in various parts of the country, supplied with attendants. The best institutions of the kind in ancient times were undoubtedly in Rome. The inscription upon a tablet discovered near Piacenza, dated in the time of Trajan, shows that the Romans not only possessed such houses, but that they were actually endowed. One of the earliest hospitals on record was probably that founded by Valens in Cæsarea, between A.D. 370 and 380.

At the present time two general classes of hospital relief work are carried on in the large cities of the world. In *dispensaries* patients are treated who are able to be about and have temporary or serious illness, not sufficiently severe to confine them to bed. In *hospitals* patients are treated who must be confined to their beds, for certain times at least. Many dispensaries are associated with teaching institutions and are then termed *clinics,* and the patients who come are, in some instances, utilized to instruct the students of medicine. The word infirmary is a common English term for both dispensaries and hospitals.

The term hospital is now rarely used for those custodial and teaching institutions that care for foundlings and orphans. These are termed asylums, or homes, or colleges. A number in England retain the old name, such as Christ's Hospital in London, Heriot's Hospital, Donaldson's Hospital, Edinburgh, etc. Similarly, institutions for the aged and indigent at the present time are rarely termed hospitals, but homes, almshouses, etc. Thus the term hospital has come to be restricted to an institution in which the sick are treated, whether such illness be of the brain or of other parts of the body.

The history of the development of the modern hospital is both interesting and instructive. One of the earliest of recognized hospitals was in France, and the present Hôtel Dieu of Paris is supposed to have had its origin as early as the seventh century. During the Crusades many hospitals were built, and there arose a special class, the *Hospitalers,* or knights whose duty it was to take care of the sick. The present Orders of Sisters of Mercy, Sisters of Charity, and allied societies, had a somewhat similar origin. With the establishment of the schools of learning, and more particularly with the development of the study of medicine, many of the hospitals formed departments in the universities, and the university towns developed large and important hospital facilities. Bologna and the Italian towns led the way. Paris and the schools of France followed, and in England and Scotland the hospitals of London and Edinburgh were the great medical schools. Thus Saint Thomas's, of London, was established in 1553; Saint Bartholomew's in 1546, where, in 1609, Harvey, who discovered the real nature of the circulation, was physician; and Bethlehem in 1547. The hospitals of the United States were largely founded on English models, although the influence of the French school was not absent in the early history of this country. It seems probable that the earliest hospital founded in the United States was the Pennsylvania Hospital, although there were earlier institutions in Canada and Mexico.

Efforts were set on foot as early as 1709 to establish a hospital in Philadelphia. In 1730-31 the city almshouse was founded, and did medical work; but it was not until 1750-51 that the Pennsylvania Hospital first had its actual birth. Joshua Crosby was the first president of the board of managers, and Benjamin Franklin the first clerk. The New York Hospital was the second hospital of importance. Its charter was granted in 1771. From these early beginnings there has now grown up in the United States a veritable forest of hospitals. Every city, town, and village has its duly appointed hospitals, and the hospitals of the United States are now acknowledged the most handsomely and thoroughly equipped in the world; they serve as models for European architects.

In most of the larger cities of the United States there are two or more hospitals that are under the control of the city government, and used exclusively for the city poor. Such are the Johns Hopkins Hospital, in Baltimore; the Philadelphia Hospital, in Philadelphia; Bellevue, City, Fordham, Harlem, and Gouverneur hospitals in New York; Massachusetts General, and Boston City, in Boston; Cook County Hospital, in Chicago; etc. In addition to these municipal hospitals there are numerous institutions founded by private gift and by sectarian societies, such as the New York Hospital, Roosevelt, Presbyterian, Saint Luke's, German, French, Mount Sinai, Saint Vincent's, Saint Mark's hospitals, etc., etc., in New York, and hundreds of others in other cities. Further, there are numberless special hospitals for the treatment of separate diseases: hospitals for diseases of the eye, the ear, the nose, the throat; cancer hospitals; hospitals for diseases of women; for diseases of the skin, and for all the various specialties.

The details of hospital management cannot be entered into here. The medical side of the work is usually fashioned on well-established lines. In the larger hospitals the patients are immediately cared for by the nurses (nurses are paid a small salary unless they are sisters of some religious denomination); these are under the orders, so far as the treatment is concerned, of the *internes*, or young graduates in medicine who have gained this privilege by competitive examinations, and who serve in graded positions for periods of time of from one to three years. These generally reside in the hospital, receive no salary, save their living, and are constantly in attendance. The *externes*, on the other hand, are under the supervision of the *attending* or *visiting physicians*, who are practitioners in the city, chosen by the governing boards of the hospitals for their ability or for other reasons. These visit the hospitals at specified times, and outline the plans of treatment for the patients. Their time and services are usually given gratis, always so in the municipal hospitals. Many hospitals have consulting physicians who may be called in to diagnose rare conditions, but such appointments are usually rewards for work done in the other grades, and carry with them honor and position in the estimation of the laity.

In the smaller hospitals this system may be much modified to meet the circumstances, but the main features are preserved.

Chiefly within the past century a system of hospitals specially designed for the care and treatment of the insane has been established all over the world. In this country these institutions are supported by the several States. The State of New York has sixteen such hospitals, each accommodating from a few hundred to a few thousand patients. The physicians who serve in these hospitals are specialists in mental diseases, and receive salaries which vary with the length of service. Very recently acute psychopathic hospitals have been established in some of the large cities in connection with the principal general hospitals. In these institutions patients afflicted with mild and curable forms of mental trouble receive treatment without being regularly committed to an insane asylum. Such are the insane pavilions in Bellevue and Kings County hospitals, in New York. See NURSES, TRAINING OF. Consult Burdett, *The Hospitals and Asylums of the World* (London, 1891).

MILITARY HOSPITALS. These are hospitals designed and erected for the exclusive use of soldiers, and in some instances sailors, including every form of establishment, from the field dressing station, or first hospital, keeping pace with the firing line, to the permanent institutions of the home country. Naturally, military hospitals are of comparatively recent origin; born of the needs of warfare, and the advance of medical science and hygiene. In the Crimean War of 1854 the French alone of the allied powers possessed anything approaching the equipment now common to all armies. The English wounded were carried off the field in rough-and-ready fashion, sailors' hammocks being ultimately utilized as a rude substitute for the French stretcher and ambulance. Surgeons dressed the wounded on the field, for whom there was little or no after accommodation, until, spurred by the publication of Florence Nightingale's description of conditions, and the reports of special committees, the Government appointed Lord Herbert's commission, which resulted in more effective hospital service. Similarly, the great Civil War of America in 1861 may be said to be the parent of the present United States Army Hospital Service, if not also of the entire European system, the English branch of which proved so effective in the Boer-British War of 1899. The dread of soldier and sailor alike, and the equal despair of the surgeon, had up to 1861 been a swift and often fatal form of gangrene, peculiar to naval and military hospitals; this, with many other equally deadly phases of the old system, was effectually remedied during the Civil War. The desperate character of the fighting taxed the general surgical capacity of the nation; and with the gradual advance in hygiene, bacteriology, and antiseptic surgery, undoubtedly led to the comparative perfection of to-day.

PERMANENT AND FIELD HOSPITALS. Modern military hospitals may be divided into two general classes—permanent, and war or field hospitals. To the former belong the hospitals attached to army posts and permanent military stations, as well as such institutions as the General Military Hospital, Fort Bayard, N. M.; Netley Hospital, England; and the Val-de-Grace, Paris, France. The United States Army shares with the Navy the advantages of the general hospital at Hot Springs, Ark., which is set apart for patients suffering from such diseases as the waters of the hot springs have the reputation of benefiting, except that cases of venereal diseases are not admitted. Admission to this hospital is restricted to the army and navy, including officers of the revenue-cutter service and of the marine-hospital service, and honorably discharged soldiers and sailors of the regular and volunteer army and navy, in the following order of preference: (1) Officers and enlisted men of the army, navy, and marine corps on the active lists, and cadets at the military and naval academies; (2) officers and enlisted men of the same service on the retired lists; (3) officers of the revenue-cutter service and of the marine-hospital service; (4) honorably discharged soldiers and sailors of the regular and volunteer army and navy may be admitted by authority of the Surgeon-General when there are vacant beds. The general hospital at Fort Bayard, N. M., is set apart as a sanitarium for the treatment of officers and enlisted men of the army suffering from pulmonary tuberculosis. In the regular hospital service of the United States a limited number of women are employed as hospital matrons at posts and arsenals, and also as nurses in numbers fixed by the Surgeon-General, as described below.

Field hospitals are organized according to the needs and character of the campaign, the theatre of operations, climate, and season of the year—the primary object being to evacuate the front of sick and disabled troops without interfering with the mobility of the combatants. In connection with field hospitals there is always present the transport difficulty, consequently every effort is made to lighten the total weight of equipment carried. Bearer and ambulance companies and field hospitals are essentially mobile units—their equipment usually consisting of a few small tents without beds. In the British-Boer War of 1899 the English field hospital weighed about eight tons, accommodated 100 patients, and could be pitched or struck and packed on wagons in an hour's time. Stationary hospitals are usually rest camps on long lines of communication. *General hospitals* are places to which all sick and wounded are ultimately sent; where all important surgical and medical treatment, not imperatively urgent, is carried out; and where it is determined whether the patient shall be returned to civil life or active service. In every army special corps of men are enlisted and trained during time of peace; the field-hospital section during the great annual army manœuvres of Europe receiving very practical instruction. While all civilized countries are quick to avail themselves of needed improvements, France is usually in the lead.

HOSPITAL TRAINS. Modern wars of Continental Europe have developed a phase of hospital service peculiar to themselves and known as hospital trains, of which there are three distinct types—permanent, improvised, and ordinary. The first named will serve as an illustration. They are constructed so as to contain kitchen, storeroom, and compartments for the sick, who are invariably lying-down patients, demanding constant attention. There is through communication from the front to rear. In Germany they are known as *Lazaret-Züge*, and consist of 41 carriages, with an average total capacity of 300 patients; the *Trains-Sanitaires-Permanents* of the French have 23 coaches, with a capacity of 128; the Austrian *Eisenbahn Sanitäts-Züge*, 19 carriages and 104 sick-berths; and the Italian *Treni Ospedali*, ranging from 19 to 24 carriages, with accommodations for about 200. There are also similar trains belonging to the Société Française, and the Austro-Hungarian Knights of Malta. Hospital trains are conspicuously marked with the badge of the Geneva Society, but are so arranged internally that distinctions of rank and caste are rigorously maintained in the accommodations set apart for sufferers, utterly regardless of the necessities or circumstances of the case.

THE ARMY NURSE CORPS is an auxiliary branch of the medical department. In accordance with an army bill passed February 2, 1901, it was ordered that army nurses should be assigned to duty at military hospitals, and at hospitals where more than one nurse is serving one will be assigned to duty as chief. They are appointed for three years, two years of which period must be served without the limit of the United States. The pay and allowance of a nurse on active service is $40 per month, when on duty in the United States and abroad. Chief nurses receive $5 extra, except where there are five or more nurses under them, when they receive $10 extra, and $25 extra when they have charge of ten or more subordinates. Nurses are retired on reaching the age of forty-five years, or if they cease for five years to practice their profession, or if they become permanently incapacitated, from illness or other good or sufficient reason. The uniform of the corps consists of a waist and skirt of suitable white material, adjustable white cuffs, bishop collar, white apron, and cap. The badge of the corps is the cross of the medical department and hospital corps, in green enamel with gilt edge, pinned on the left side of the collar of the uniform, or on a corresponding part of the nurse's dress when she is not in uniform. See MEDICAL DEPARTMENT; and SURGERY, MILITARY.

HOSPITAL CORPS, UNITED STATES. In the United States recruits are enlisted for the Hospital Corps, and permanently attached to the Medical Department; and in time of war perform the necessary ambulance service under such officers of the Medical Department and assistants as may be detailed for that duty. They are not required to perform any military duties other than those pertaining to their corps; receiving instruction in such drills, both foot and mounted, as are necessary for their efficiency. Their equipment consists of canteen complete, waist-belt and plate, one-half shelter tent complete, and in the case of privates, pouch and litter-sling. At every permanent military post there is at least one non-commissioned officer of the Hospital Corps, and an additional one for every additional four privates of the corps. Special instructions in the duties of litter-bearer and the methods of rendering first aid to the sick and wounded are given to all enlisted men of the line of the army by their company officers, for at least four hours in each month, except in the case of the seacoast artillery, which is limited to one hour per month, post surgeons under the direction of post commanders being responsible for the professional instruction of the company officers.

In field service troops are accompanied by detachments of the Hospital Corps, each medical officer, on the march, being attended by a mounted private of the hospital corps. Members are not permitted to carry arms except under circumstances where their rights as non-combatants, under the Geneva Convention, are not likely to be recognized.

HOSPITALERS (OF. *hospitalier*, from ML. *hospitalarius*, from *hospitale*, hospital, inn, from Lat. *hospitalis*, relating to a guest, from *hospes*, guest). Charitable brotherhoods, founded at various times and in different countries, for the care of the sick in hospitals. The vow to devote one's self to this work of mercy is usually superadded to the ordinary vows of poverty, chastity, and obedience, commanded by Saint Augustine. One of the earliest recorded instances of such a brotherhood is the Order of Madonna della Scala, in Italy in the ninth century. The Knights of Saint John of Jerusalem (q.v.), as also the Teutonic Knights (q.v.), were originally hospitalers. There are many other local institutes or congregations having various names and living under various rules.

HOSPITAL SHIP. A ship designed to take care of the sick and wounded either as a floating hospital or as a transport hospital. The second Geneva Convention in 1868 provided that hospital ships, merchantmen (i.e. unarmed ships not used for any military or naval purpose), having wounded on board, and boats picking up wounded or wrecked men, shall be neutral. They are required to fly the red cross flag and their men must wear the red cross armlet. Government hospital ships are required to be painted white with a broad longitudinal green stripe on each side extending from bow to stern; hospital ships belonging to aid societies to be similarly painted, but the stripe is to be red. Both varieties of ships must fly the red cross flag as well as their national ensign, and no arms of any sort are to be allowed on board. Any evidence amounting to presumption that the enemy is violating the rules of the convention and using the ships for improper purposes constitutes sufficient ground for refusing the further granting of immunity until the contrary is proved.

HOSPITAL SUNDAY. In the United States, the last Sunday of December; in England, the Sunday nearest June 15th, on which days the collections in the churches are devoted to the support of hospitals. The custom has been generally adopted since 1873.

HOS'PODAR (Upper Sorbian, master, lord). A title formerly given to the governors of Moldavia and Wallachia. Hospodar (*gospodar*, *gospod*, *gospodin*, in the various Slav languages) means simply 'master.' The hospodar held his power at the pleasure of the Sultan, who made a practice of farming out the office to the highest bidder. The incumbent held his office for a short period, or else secured reappointment by repeated gifts. The Lithuanian princes were likewise called hospodars, and the Polish kings, down to the time of Sobieski, assumed that title in their diplomatic negotiations with Russia. *Gosudar* (ruler, monarch) is even now one of the titles of the Emperor of Russia.

HOST. See LORD'S SUPPER.

HOSTAGE (OF. *hostage*, *ostage*, Fr. *ôtage*, It. *ostaggio*, from Lat. *obsidatus*, state of being a hostage, from *obses*, OLat. *opses*, hostage, from *obsidere*, to remain, from *ob*, at + *sidere*, to sit; influenced in popular etymology by Lat. *hostis*). A person or thing given in pledge for the performance of conditions. When a town capitulates, victors and vanquished usually give into the custody, one of the other, several officers, as pledges that each party will duly carry out the terms stipulated. When the terms are fulfilled the hostages are exchanged; but if the terms be evaded the opposite side holds the right to put to death or otherwise punish the hostages in its possession.

HOSTIL'IUS, TULLUS. A semi-legendary King of Rome, grandson of Hostus Hostilius, the champion of Rome in the first war with the Sabines; he succeeded Numa Pompilius on the throne of Rome, B.C. 670 (according to the common chronology). According to Livy and other writers, Hostilius made the famous arrangement, by the combat of the Horatii with the Curiatii, for the decision of the question of supremacy between Rome and Alba, which was decided in favor of the former; he fought against Fidenæ and Veii, and conquered these cities, destroyed Alba, and removed the inhabitants to Rome, settling them on Mons Cælius, and carried on war against the Sabines. He is said to have reigned to about B.C. 638. The story of the earlier Kings of Rome is mere legend, but doubtless contains some germs of truth, though the personality and name of Tullus Hostilius are not to be credited.

HOS'TIUS. A Roman poet of the second century B.C., author of metrical annals after the manner of Ennius, and *Bellum Histricum*, a poem on the Istrian War. Fragments of the latter work, quoted by Macrobius (v. i. 3, 5) and Servius (ad *Æn.* xii. 121), are printed in Baehrens, *Fragmenta Poetarum Romanorum* (1886). Some authorities think he is the original of the *doctus avus* of Propertius (iv. 20, 8).

HOSTRUP, hŏs'trụp, JENS CHRISTIAN (1818-92). A Danish poet and dramatist, born at Copenhagen. His first comedy, *Gjenboerne* (1843, published in 1847), was acted by his fellow students before he left the university. It was played afterwards at the Royal Theatre, and remains a favorite piece. Among his other plays, composed under the pseudonym of Kristrup, are *Intrigerne* (1846); *En Spurv i Tranedands* (1850); *Eventyrpaa Fodreisen* (1850); *Soldaterlöjer* (1849); *En Vat Mellem Fjeldene* (1852, music by Emil Hartmann), and *Mester og Loerling* (1852). From 1855, when he took orders, to 1881, he had charge of a parish. A volume of his poems, *Sange og Digte*, appeared in 1884, and his drama, *Eva*, in 1881. After this he wrote little but what was demanded by his parochial work. The last years of his life were spent at Copenhagen. His popularity is largely due to the national character of his plays, his humor without vulgarity, and the vivacity of his dialogue. His poetical writings were collected in six volumes (1852-56), and a fifth edition of his comedies was published in 1888-89.

HOT-AIR ENGINE. See CALORIC ENGINE.

HOTBED. A bed of fermenting compost or manure covered with a layer of earth, and generally surmounted by a frame, for the cultivation of plants which require more than the natural heat of the climate or season, but not so much as to render the hothouse necessary. The heat is the result of fermentation. Hotbeds are in very general use for growing plants from seed in spring, to be planted in the open ground as summer advances, and for forcing vegetables and flowers. The material mostly used is horse manure, either alone or mixed with litter; but tan-bark, leaves, the waste of flax, cotton, or woolen factories, etc., are sometimes substituted for it. It is necessary that the heat of very rapid fermentation be expended before the hotbed is planted; and it is usual, on this account, to prepare the materials some days in advance of planting. A hotbed is made highest at the back, sloping toward the south. The bed extends on all sides 12 inches or more beyond the frame, according to the temperature of the outside air. The frame has a movable glass sash or sashes, according to its size, or is covered with cloth. The thickness of the hotbed, and of the earth upon it, is accommodated to the purpose intended and the degree of heat required. When the heat decreases it is for some purposes necessary to keep it up by 'linings' of the same material as the hotbed, added to the sides of it. The sashes of hotbeds must be partially removed during the day to permit ventilation and the escape of vapor.

HOTCH'KISS, Benjamin Berkely (1826-85). An American inventor, born in Watertown, Conn., of humble parentage. He was at an early age employed in a gun-factory, where he came into contact with Samuel Colt (q.v.), in the manufacture of revolvers. During the Civil War he was engaged in the manufacture of ordnance in New York, and later invented the Hotchkiss magazine gun, used by the United States troops in the West and the United States Marine Corps. This was followed in 1882 by the Hotchkiss machine gun, for use in the fighting tops of war-vessels. He was also the inventor of several important improvements in projectiles and heavy ordnance. His guns were in general use throughout the armies and navies of the world until displaced in the more advanced nations by later inventions. His death occurred in Paris, where in 1870 he established a gun-factory, a branch of which he was organizing in England at the time of his death. See Machine Gun and Rapid-Firing Gun.

HOTCHKISS GUN. See Machine Gun; Rapid-Fire Gun; Ordnance.

HOTCHPOT (OF. *hochepot*, from ODutch *hutspot*, chopped beef or mutton boiled in a pot, from *hutsen*, *hotsen*, to shake + *pot*, AS. *pott*, from Ir. *pota*, *puite*, Welsh *pot*, Bret. *pōd*, pot; connected with Lat. *potare*, Skt. *pā*, to drink, Gk. *ποτός*, *potos*, drunk). The mixing and blending together of advancements made to children during a parent's life and of property left at his death, in order that the whole may be equally divided among all the children. According to Blackstone the doctrine came into English jurisprudence from the law of the Lombards, but the term is explained by him in the language of Littleton, as follows: "Hotchpot is in English a pudding; for in a pudding is not commonly put one thing alone. but one thing with other things together." By this housewifely metaphor, adds Blackstone, our ancestors meant to inform us that the lands which had been given to one or more daughters in frank marriage, as well as the lands descending in fee simple, should be mixed and blended together and then divided among all the daughters. After estates in frank marriage fell into disuse the principle of the law of hotchpot was revived and applied by the statute of distributions (22 and 23 Car. II., ch. 10). The provisions of this statute have been reënacted by the Legislatures of our States with some shades of difference, and on the basis of the rules as to hotchpot throughout this country. The great object of these rules is to produce equality among the children of a deceased person. Property which has been turned over to a child as an advancement, instead of a pure gift, is to be brought into hotchpot as a condition of his taking a child's share in the parent's estate. It is not necessary that he actually bring and surrender the very chattel or other form of property advanced to him. It is enough that its fair value be accounted for and added to the decedent's estate. In arriving at this value its worth is to be estimated at the death of the parent, relation being had to its situation at the time of advancement. Accordingly, where a slave boy, twelve years old, was given to a child as an advancement, the child was chargeable with the fair value of such a boy at the father's death; not the value of the particular slave who was then an adult. So the profits of an advancement, or the enhanced value due to improvements, are not to be accounted for. Consult the *Commentaries* of Blackstone and Kent.

HOTEL (Fr. *hôtel*, OF. *hostel*, from ML. *hospitale*, large house, palace, inn). The origin of the modern hotel, especially in the United States, dates from the introduction of the railroad. Its advent transformed the small road-house, which was planned for occasional guests, into the more pretentious hotel. Again, about 1888, came another revolution in hotel-building, and the modern fireproof structures began to replace their poorly planned prototypes. Still later, the idea of specialization, that is, of providing particularly for a certain class in the community, began to gain ground. In the United States there are three general kinds of hotels: (1) Those which are run on the American plan; (2) those using the European plan; and (3) those combining both systems. The European plan, on which practically all the great hotels of Europe are run, consists in paying a certain daily rate for a room, and then paying separately for whatever food is ordered. By the American plan the guest pays a certain amount a day for both room and meals. The difference between an American hotel which is run on the European plan and the Continental hotel, is that in the former the various minor items, such as light and service, are included in the price of the room; while on the Continent these items are often charged for separately. One of the most characteristic establishments of Europe is the road-house, which is found throughout the Continent, but especially in France, Germany, and Austria. It is, as a rule, marked by simplicity and comfort and is preferred by many to the more elaborate hotel. Indeed, the small hotel in Europe is a model of its kind, and its cuisine is generally superior to that of second-class hotels in this country. The large first-class hotels of the United States are, however, unexcelled. The following description applies to the modern hotel.

By far the greater part of the space in a hotel is occupied with private rooms for guests, but the central feature of the design of a modern hotel is the great office and lobby, which is the common place for arrival and departure, and for meeting people from both without and within the building. A large and generally imposing entrance and vestibule lead to the office or lobby, which frequently occupies an inclosed central court, two or three stories in height. The lobby generally contains not only the public office of the hotel, but also news and cigar stands, a telegraph office, and telephone booths; or, if these are not in, they are adjacent to and connect with the lobby. Reading, writing, and smoking rooms also adjoin the lobby, and there may be a parlor or reception-room near at hand. The hotel parlors are more generally on an upper floor, commonly on the second. Both public and private parlors are usually provided. Another marked feature of a hotel is its dining-room. Here the object is to get a large, unobstructed floor-space, with plenty of natural light, where possible, and at the same time to have the room only second in general accessibility to the lobby or office. Smaller public dining-rooms, frequently called breakfast-rooms, are generally provided, and also a gentlemen's café, besides which there are private dining-rooms in proportion to the size and general character of the hotel. A conspicuous feature of hotels in this country is the bar, which is likely to be near, if not connected with, the café. The bar is often on the office floor, but where this floor is well above the street level the bar and café, together with barber-shops, lavatories, and, perhaps, the public baths, are in the basement. The hotel kitchen must be either near or in speedy communication with the dining-room. It may be on a different floor, if dumb-waiters are provided. Where there are numerous dining-rooms, public and private, several kitchens are a practical necessity.

Spacious stairways almost invariably lead from the office or lobby to the parlor or dining-room, although the universal use of elevators has lessened their importance. An impressive feature of some of the finest hotels is a gallery above and around the lobby, giving access to whatever public rooms may be located on the second floor. The elevators should be conveniently arranged so as to give quick access to private dining-rooms, ballrooms, and parlors; and there should be separate elevators for servants and freight. The guests' rooms, if any, on the second floor of large hotels, are generally in suites (bedroom, parlor, and bathroom), but similar suites may, of course, be distributed on the other floors. Above the second floor the building commonly assumes, at least in city hotels, the form of a hollow square, or rectangle. The guests' rooms are arranged along corridors, the outer ones fronting on the street, the inner ones on the court. Even third or fourth rate hotels of the present day rarely offer guests a room which does not have an ample window opening into the outer air. Fire-escapes must be provided on each floor, and red lights are placed near them and at the heads of staircases to mark their location. Besides the various rooms, public and private, already mentioned, baggage and storage rooms, ballrooms, halls for concerts, conventions, and other assemblies, music-rooms, and sometimes roof gardens, are, some or all, found in the best hotels.

Mountain and seaside resorts call for various modifications in design, including many spacious verandas and balconies, sun-parlors for winter use, and other features suited to the changed conditions of a hotel life where recreation and social amusements, or perhaps the search for health, are the main objects. The constructional features of hotels are not sufficiently different in the material employed and the way in which it is put together to require separate treatment.

The governing principle in the design of a hotel should be to make it as safe, convenient, comfortable, and generally attractive as possible. Unfortunately, the order of these requirements sometimes is reversed; or, at least, inadequate attention is given to the safety of the guests. Safety is used broadly here, to include all that goes to make the building structurally sound, to reduce dangers from fire, and to conduce to good sanitation. Fireproof construction (q.v.) should be employed as far as possible, and there should be adequate fire-escapes and fire-protection facilities. The latter, at least in all large hotels, include apparatus in the way of fire-pumps, standpipes, hose, chemical extinguishers, and the like. A plentiful supply of water is, of course, essential. This necessity frequently entails an independent pumping plant, and always requires an extensive system of piping for both hot and cold water. To meet the demands for purity in drinking-water, it is frequently advisable to install a filter plant in the basement of the hotel, or, where possible, to sink deep artesian wells. Spring waters are often supplied at table.

Both public and private baths are required. The latter should be in separate rooms with independent air and light. Private water-closets generally accompany private baths. The public lavatories and water-closets, both as regards spaciousness and good sanitation, may be taken as a fair index of the rank of most hotels. In general, all plumbing should be of the simplest possible design and should be readily accessible for inspection and repairs. In the choice of floors and floor-coverings, wall finish and decorations, window and other hangings, it should never be forgotten that frequent and thorough cleansing is imperative, and that everything that creates or serves as a lodging-place for dust, or that cannot be thoroughly disinfected, is a menace to health. Ventilation is most important and, together with heating, its arrangement should be intrusted to a heating and ventilation engineer. In the best hotels in the colder sections of America, the buildings are heated with steam or hot water throughout, supplemented, in some instances, by open fireplaces. Well-equipped laundries, with drying closets, are becoming more and more common even in smaller hotels. Either gas or electric lights, and frequently both, are provided in most hotels.

Whatever the rank of a hotel, some means is provided for making known wants without leaving one's room. The most common method is a simple push-button electrically connected with an annunciator in the hotel office. In some hotels elaborate signal systems are provided so that by moving a pointer over a dial in one's room any want may be made known in the office. Such cumbersome devices, however, bid fair to be superseded by the house telephone system, with a telephone in every room.

The management of modern hotels presents a difficult executive problem. The number of employees (which varies according to the hotel, but which is always over 50 per cent. of the guests), the constantly shifting crowd of guests, the numberless mechanical details, and the large amount of provisions and supplies which is necessary, all complicate the problem. Under the manager, and directly responsible to him, are a steward and a chef. The former has charge of the supplies and general supervision over the housekeeper, storekeeper, head laundress (and their subordinates), and over the clerks of the accounting department and the plumbers, carpenters, and upholsterers. The steward also generally buys the necessary provisions and supplies. Most of the provisions are ordered fresh every day, though usually the larder is stocked with a supply sufficient for two days, while the supply of dry stuff on hand is sufficient for a week. The chef has absolute charge of the kitchen and its staff. The steward makes his purchases according to lists furnished him by the chef, who oversees all details in connection with the cuisine. A head waiter superintends the dining-rooms and arranges for private dinners and suppers. For the history of the early hotel, see Inn.

HOTEL (in law). See Inn, Innkeeper.

HÔTEL DE CLUNY, ō'tĕl' de klu̧'nē'. See Cluny, Hôtel de.

HÔTEL DE RAMBOUILLET, de rän'bōō'yȧ'. See Rambouillet, Hôtel de.

HÔTEL DES INVALIDES, dȧ zăn'vȧ'lēd'. See Invalides.

HÔTEL DE VILLE, de vēl. The city hall of Paris. The seat of the municipal government was originally on the left bank of the Seine, whence it was transferred to a position near the Châtelet on the right bank in the thirteenth century, and in 1357 was established in a building on the Place de Grève, now the Place de l'Hôtel de Ville. Under Francis I. the building had been outgrown, and a new edifice was begun, which was completed under Henry IV. It was totally destroyed by the Communists in 1871, with the loss of 600 of their companions who were unable to escape from the building, and was rebuilt between 1873 and 1883. The new building is a fine Renaissance structure, with an imposing façade enriched with allegorical groups and single statues typifying the principal French cities. The interior is richly ornamented with sculpture and paintings by great French artists, and contains a fine grand staircase and a large decorated hall. Generically, the name is applied by the French to any town hall.

HÔTEL DIEU, dyē. One of the oldest hospitals in Europe and the most important in Paris, said to have been founded in 660. It formerly stood on the south side of the Ile de la Cité, and was connected with an annex on the right bank of the Seine. In 1772 the hospital was destroyed and subsequently rebuilt on the same spot. The institution was transferred in 1868 to its present position on the north side of the island, near Notre Dame. It contains 559 beds, and three medical professorships are attached to it.

HOTHO, hō'tō, Heinrich Gustav (1802-73). A German art historian, born in Berlin. He studied at the university of his native city, in 1829 became one of its professors, and the next year was appointed assistant director of the gallery of paintings in the Royal Museum. He was well known as a disciple of Hegel, for the complete edition of whose works he elaborated the *Vorlesungen über Aesthetik* (3 vols., 2d ed. 1842-43). In addition he published *Geschichte der deutschen und niederländischen Malerei* (1842-43); *Die Malerschule Huberts van Eyck* (2 vols., 1855-58); *Die Meisterwerke der Malerei vom Ende des 3. bis Anfang des 18. Jahrhunderts in photo- und photolithographischen Nachbildungen* (1865); and an unfinished work entitled *Geschichte der christlichen Malerei* (1867-72).

HOTHOUSE. A building intended for the cultivation of exotic plants which require a higher temperature than that of the open air. The term is more generally applied to those buildings in which artificial heat is used. It includes such terms as 'stove,' 'bark stove,' etc., in the former of which the heat was derived from fires, and in the latter by fermenting tan-bark, which not only produced heat, but kept the air moist. See Greenhouse.

HOTMAN, ōt'män', or **HOTMAN'NUS,** François (1524-90). A French jurist and author, born in Paris. He received the degree of doctor at Orleans, and afterwards, though but twenty-two years old, gave lectures on Roman law at the University of Paris. At this time he became a convert to the reformed religion, and was forced to take refuge in Geneva. On the recommendation of Calvin, he was made professor of belles-lettres at Lausanne in 1549. Afterwards he went to Strassburg as professor of civil law; then to Valence (1562) and Bourges (1567). For a short time he returned to Paris, but the massacre of Saint Bartholomew sent him back to Geneva. His last years were spent at Basel. Hotman's books had a great influence on the time, and wrought a reformation in the study and teaching of law. His two most important works are *L'Anti-tribonian, ou discours sur l'étude des lois* (1567), and *Franco-Gallia* (1573), often reprinted with changes of matter and titles.

HOT SPRINGS. A city and the county-seat of Garland County, Ark., 50 miles west by south of Little Rock; on the Choctaw, Oklahoma and Gulf, and the Saint Louis, Iron Mountain and Southern railroads (Map: Arkansas, C 3). It is one of the most beautiful towns in the United States, and is widely noted for the hot waters that flow from 72 springs, included in a space of 10 acres on the west side of Hot Springs Mountain. The waters of these springs range in temperature from 76° to 157° Fahr., and are beneficial in a multitude of diseases. In 1832 four sections of land, the thermal springs being in the centre of the district, were set off by Congress as a Government reservation. Since then the Government has established on the mountain the Army and Navy General Hospital, and expended large sums in improving and developing the reservation. The Government bath-houses, extending along Central Avenue, are tasteful in design, and have attractive surroundings. There are many hotels here, the Eastman, the Arlington, and the Park ranking among the largest in the country; and the city is one of the most popular resorts in America, having annually 100,000 visitors. Settled about 1804, Hot Springs was incorporated as a town in 1876, and was chartered as a city of the first class in 1879. The government is administered by a mayor, elected every two years, and a municipal council, of which the executive is a member. Population, in 1890, 8086; in 1900, 9973.

HOT SPRINGS. A town in Madison County, N. C., 38 miles northwest of Asheville; on the

French Broad River, and on the Southern Railway (Map: North Carolina, B 4). It has a fine site at an elevation of over 1300 feet, in a picturesque valley inclosed by high mountains, and is a noted health resort because of the medicinal value of its hot mineral waters. Dorland Institute, a mission boarding-school for mountaineers, was established here in 1894. The principal industries are lumbering and mining. Population, in 1890, 695; in 1900, 445.

HOT SPRINGS. A city and the county-seat of Fall River County, S. D., 106 miles south of Deadwood; on Fall River, and on the Burlington and Missouri River and the Fremont, Elkhorn and Missouri Valley railroads (Map: South Dakota, B 6). It is noted for its thermal and medicinal springs, and is the seat of the State Soldiers' Home and of Black Hills College (Methodist Episcopal), opened in 1890. The city is the commercial centre for important mining, live stock, and lumber interests, and has a good water-power and manufactures of stucco. Population, in 1890, 1423; in 1900, 1319.

HOTSPUR. A name given to Henry Percy (q.v.).

HOTTENTOT FIGS. See ICE-PLANT.

HOTTENTOTS (*Khoi-Khoin*, Men of Men). A dwarf race in Namaland, South Africa (census of 1891, 50,388). Their domain is said to extend from Orange River to Walfish Bay and far into the Damara upland. A study of their somatology shows them to have the following characteristics: Cranial capacity, 1290; cephalic index, 74.3. Their skin is yellow, brown, or gray, not black; the hair is long and woolly; the cheek-bones are prominent; eyes are dark chestnut or black, wide apart; the nose is very broad and flat, nostrils thick; the mouth is large, with heavy, upturning lips, and enormous prognathism, chin pointed, and receding jaw. They have little beard, and no hair on the body. The ears are large, without lobules. (See Colored Plate of AFRICA, DARK RACES OF.) Steatopygia is common. There are three divisions of them, the Hottentots proper, the mongrel Griquas of Griqualand West, and the Koranas on the Orange, Vaal, and Modder rivers. They, or the Bushmen, their kindred, and not the negroes of the family of Bantu, are doubtless the aborigines of the country, but between the persecutions of the spreading Bantu tribes and later the occupation of the lowlands by Dutch and English settlers, most of them have been driven into the mountains and waste places, and they are slowly dying out. They live in low, oval, dome-shaped huts, made by setting rough poles in the ground, bending them down and tying them together. Over all is a thatch or layer of mats woven by the women. In the centre of each hut is the fire-pit where meat is roasted, and around the sides are holes in which they sleep. They wear little costume beyond a cloak of skin, but smear their bodies lavishly with fat and soot. At the time of the advent of the Europeans their wealth consisted largely in cattle. Their chief weapons were bows and poisoned arrows. In their villages the huts were arranged in a circle, forming what is known as a kraal. A portion of the Hottentots shared the fortunes and stood the oppressions of the settlers, and their descendants form a mixed race, many of whom are prosperous in flocks and herds.

Hottentot men do little work besides helping to tend cattle and occasionally hunting and fishing. Some pursue the trades of smith or armorer, tailor or tanner. The women make cords, mats, and pottery, cook, tend cattle, and perform most of the labor.

Trade is carried on by barter in cattle, and oxen are used for bearing burdens. Little beef is eaten, and meat is procured by hunting, milk being the chief food; from their environment the Hottentots secure many roots and fruits, which supply the vegetable element in their diet. Cooking of meat is by roasting or seething in a skin bag by means of hot stones. They make an intoxicating mead and chew a narcotic root.

Puberty, marriage, and funeral feasts are held. Their amusements are mock fights, games accompanied with music, drinking, and smoking. Family affection seems strong, and they are friendly, liberal, and hospitable among themselves.

Their yellow skin has been an enigma to anthropologists, and the discovery of similarities in grammar, together with the existence of words representing abstractions of a high order, strengthened the theory that the Bushmen Hottentots had separated from the Caucasian kindred in the north in prehistoric times, settling the southern portion of the continent, where they were pressed upon later by the black Bantu tribes. More probably they are an isolated race, like the Australians. The theory that they are lost Hamites is weakened by the fact that their language has elements resembling those of other races. The clicks in the vocal sounds, resembling the smacking of the mouth in clucking, etc., are made by pressing the tongue against the teeth, the palate, the sides of the upper jaw, or doubling it backward and then producing an explosive noise. These clicks usually occur at the beginning of words, and while each one is not difficult to imitate, the European is quite unable to follow them up with the vocal sounds that make up the word. The name Hottentot is an effort of the Dutch to imitate the dental clicks pronounced like the expression of surprise, tut! tut! with an inhalation.

The unit of government among the Hottentots was the kraal, with its subchief, who, with the leading men, had jurisdiction even to the extent of the death penalty. The tribes were ruled by hereditary chiefs, who were greatly revered and received their pay in kind, being entitled to a share of whatever was killed or produced. Descent was in the female line for sons, and initiation into the tribe was with ceremonial scarification of the body. Their instruments of music were the gorah, or musical bow, a rude fiddle, *l'gutha*, an imitation of European violin, a tomo, a bow rubbed with another bow, and a single-head drum.

The religious belief of the Hottentots was in keeping with their social scale and organization. They held to the existence of the soul after death. The ruler of all things is a deified patriarch, Heitsi-Eibib, or a Great Captain, Tsu-goab, who was formerly one of their mighty chiefs, and came from the East. Hence all Hottentots' graves are oriented, and when they pass a cemetery they leave stones on the spot to express good will and ask a blessing. The existence of this practice in former times enables the student to follow the trail of the Hottentot in his wanderings. The cult of these people is obscure. It has been stated that they had no temples or places of united worship, no altars on which offerings or sacrifices were laid, and no class with priestly function, yet medicine men, witch doctors, or sorcerers, were common among them, called in to heal the sick by magic. An immense folklore is based on the primitive conceptions of ghosts, charms, signs, offerings, luck, and causation by spirit influences that cram the air.

Accounts of the Hottentots are to be found in the narrative of Francisco de Almeida (1509); also in the records of the Dutch East India Company from 1652, and of the British occupation after 1795. Consult also: P. Kolben, *Present State of the Cape of Good Hope* (London, 1731-38); A. Sparman, *Voyage to the Cape of Good Hope* (Perth, 1786); Sir John Barrow, *Travels into the Interior of South Africa* (London, 1801); Emil Holub, *Seven Years in South Africa* (Eng. trans., Boston, 1881).

HOTTENTOT'S BREAD (*Testudinaria Elephantipes*). A species of the order Dioscoreaceæ, indigenous to South Africa. Its slender, many-branched, vine-like stems, which die down during the dry season, grow to a height of 30 to 40 feet, and bear bright, heart-shaped leaves. The hemispherical or nearly globular rootstock, sometimes three feet in diameter, protrudes conspicuously above ground, and is covered with a brown, cork-like substance with many-sided protuberances separated by deep cracks and fissures. Both the scientific name and one of the common names, elephant's foot, have been derived from fancied resemblances to the foot of an elephant. It is sometimes called tortoise-plant. The fleshy interior affords food to baboons and other animals, but it is said that the natives do not eat it. The rootstalks are exported apparently dead, but when placed in the ground they soon throw out rootlets and stems grow rapidly from the upper surface. The plant is cultivated as a greenhouse curiosity.

HOTTINGER, hŏt′tĭng-ẽr, Johann Heinrich (1620-67). A Swiss Orientalist and biblical scholar. He was born at Zürich. After studying at Geneva, Groningen, and Leyden, he became professor of church history in Zürich, where he remained until 1655, holding successively the chairs of theology and Oriental languages, and rhetoric and logic. In 1655 he became professor of Oriental languages at Heidelberg. In 1661 he returned to Zürich to take charge of a German translation of the Bible; and in 1662 he was elected rector of the University in Zürich, which title he kept for life. In 1667 he was called to Leyden, but was drowned at Zürich by the capsizing of his boat while on a pleasure excursion before leaving for his new work. Hottinger was a prolific writer on Oriental subjects. The most important of his works are the following: *Thesaurus Philologicus seu Clavis Scripturæ* (1649); *Historia Ecclesiastica* (1651-67); and the *Etymologicon Orientale, sive Lexicon Harmonicum Heptaglotton* (1661).

HOTTINGER, Johann Jakob (1783-1860). A Swiss historian and educator. He was born at Zürich, studied there and at Leipzig, and, returning to his birthplace, taught history in the girls' academy, in the art school, and in the university (1833). As a member of the council on education, Hottinger was prominent in the introduction of reform measures. He edited the *Archiv für Schweizer Geschichte und Landeskunde* (1827-29) and the *Schweizerisches Museum für historische Wissenschaften* (1837-39); and wrote: *Geschichte der Eidgenossen während der Zeiten der Schweizer Kirchentrennung* (1825-27); *Huldreich Zwingli* (1841); *Geschichte des Untergangs der Eidgenossenschaft der 13 Orte* (1844); and *Hans Konrad Escher von der Linth* (1852).

HOUARIOS, o͞o-ä′rē-ōz. Small coasting vessels and pleasure-boats used in parts of the Mediterranean. They bear lateen sails, and have each two masts and a bowsprit.

HOUBARA, ho͞o-bä′rȧ. See Bustard.

HOUBRAKEN, hou′brä′ken. A Dutch family of artists. Arnold (1660-1719) was born at Dordrecht, and studied under Samuel van Hoogstraeten. In 1713 he visited England. He painted a number of historical pictures and figure subjects, none of great value, and wrote a biography of Dutch painters, *Groote schoubourgh der nederlandsche konstschilders en schilderessen* (1718), which is not reliable.—His son and pupil, Jacobus (1698-1780), a well-known engraver, was also born at Dordrecht. His first work was a series of portraits for his brother's book. He did a hundred plates for *The Heads of Illustrious Persons of Great Britain* (1743-52), by T. Birchs. His individual portraits are said to number four hundred, but his best work is a series of scenes after C. Troost. After Houbraken's death engraving in the Netherlands became almost a lost art.

HOUDAN, ho͞o′dan. A breed of domestic fowls, in the French class with the crevecœur and la fleche. They are widely bred in the United States, and are hardy and profitable. These fowls are of medium size, mottled black and white in color, with black wing-bars and primaries, and a heavy crest divided in the middle of the crown in the cock, but falling backward in the hen. They have five toes, like Dorkings. A hen should weigh 6 pounds; a cock 7. The other breeds mentioned are highly esteemed in France, but little known in America.

HOUDETOT, o͞o′d′-tō′, Elisabeth Françoise Sothie de la Live de Bellegrade, Countess d' (c.1730-1813). The mistress of Rousseau and also of Saint-Lambert. She was the wife of a French general and the sister-in-law of Madame d'Epinay. Rousseau mentions her in his *Confessions*, and attributes to her influence much of his poetical inspiration. Their love is partly represented in *La nouvelle Héloïse*. Her face was plain and slightly scarred with smallpox; but she possessed a brilliant wit and a sunny disposition.

HOUDIN, o͞o′dăN′, Robert (1805-71). A French conjurer and mechanician. His apprenticeship to the watch-making trade schooled his fingers in the manipulation of intricate machinery, and his hatred of shams led him to apply his mechanical knowledge to the unveiling of the conjuring tricks of his time, especially those which appealed to the religious side of human nature. By producing more wonderful illusions, with the credit given to natural causes, than those which his predecessors had attributed to supernatural, he completely revolutionized the art of magic, and was honored by medals in 1844 and 1855 for his mechanical toys and the practical value of some of his inventions. He was the author of an autobiography, *Robert Houdin*

(1857); *Confidances* (1859); *Les tricheries des Grecs dévoilées* (1861); *Secrets de la prestidigitation et de la magie* (1868), which was reprinted ten years later as *Comment on devient sorcier*. This work and *Magie et physique amusante* (1877) were translated into English by Hoffmann.

HOUDON, o͞o'dôɴ', Jean Antoine (1741-1828). One of the foremost French sculptors of the eighteenth century. He was born at Versailles, France, March 20, 1741, the son of a domestic attached to the house of De la Motte, a courtier. His first impulse toward art came from the splendid decorative sculpture of the park at Versailles, and as a boy of ten or twelve he haunted the ateliers of the Royal School of Sculpture. In the catalogue of the Salon of 1795 he calls himself a pupil of Slodtz, but he was really much more influenced by Pigalle and the younger Lemoyne. In 1761 Houdon won the Prix de Rome, but was not influenced greatly by the treasures of art in Rome. His personality was too healthy and powerful to follow the lead of any other master, and could only be satisfied by its own direct and intelligent interpretation of nature. His stay in Rome is marked by two characteristic and important productions: the superb "Ecorché," an anatomical model, which has served as a guide to all artists since his day, and the statue of Saint Bruno in the Church of Santa Maria degli Angeli in Rome—a work of very powerful characterization.

After ten years' stay in Rome Houdon returned to Paris, and soon became one of the foremost French sculptors; he was admitted to the Academy April 23, 1769. In 1785 he visited America in company with Benjamin Franklin, in order to make the statue of Washington which had been ordered by the Legislature of Virginia. He visited Washington at Mount Vernon, and the marble statue which followed now adorns the capitol at Richmond. During the French Revolution Houdon was in danger before the Tribunal for executing a statue of Saint Scholastica, but succeeded in convincing the judges that his saint was in reality a statue of Philosophy. Houdon died July 16, 1828, in Paris.

Houdon was a perfectly trained and competent technician, producing easily and abundantly, with equal success both in marble and bronze. His knowledge of anatomy was marvelous, and he was a thorough naturalist who succeeded best in portraiture. His name is principally connected with a fine series of more than two hundred portrait busts, which form one of the chief monuments of French sculpture. Among these were those of Diderot (about 1769), Benjamin Franklin (1778), and of Gluck (1777); on the death of Rousseau in 1778 he made two busts in bronze and terra-cotta from a cast of his face. One of the most characteristic of his busts is that of Molière in the Théâtre Français, Paris. Among his statues are those of "Morpheus," in the Ecole des Beaux-Arts; "Diana the Huntress," the best of his nude female figures; and especially the portrait statue of Voltaire (1781), in the Théâtre Français, one of the finest in modern art.

HOUGH, hŭf, George Washington (1836—). An American astronomer, born in Montgomery County, N. Y. He graduated at Union College in 1856, and three years afterwards was appointed assistant astronomer at the Cincinnati Observatory. The next year he became astronomer and director of the Dudley Observatory in Albany, and in 1879 went West to become director of the Dearborn Observatory and professor of astronomy in Chicago University; but in 1887 he gave up the latter position to accept a similar one in the Northwestern University. He discovered more than 600 double stars, and invented a number of astronomical instruments. His chief publication is *Annals of the Dudley Observatory* (1866-71).

HOUGH, Walter (1859—). An American ethnologist, born at Morgantown, W. Va. He was educated at Monongalia Academy, West Virginia Agricultural College, and the University of West Virginia. He entered the employ of the Smithsonian Institution in 1886, and soon became assistant curator of its ethnological department. In 1892 he went with the United States Commission to Madrid, and was made Knight of the Order of Isabella. He was a member of Dr. J. Walter Fewkes's expedition to Arizona (1896-97), and went to Mexico with Dr. J. W. Rose (1899). He became a corresponding member of the Anthropological Society of Paris in 1899, and two years later was chosen secretary of the Anthropological Society of Washington.

HOUGHTON, hŏ'ton. A village and the county-seat of Houghton County, Mich., 94 miles northwest of Marquette; on Portage Lake, near Lake Superior, with which it is connected by a canal, and on the Duluth, South Shore and Atlantic and the Copper Range railroads (Map: Michigan, E 1). It is the centre of a rich mineral district, copper being mined and exported in great quantities. The Michigan College of Mines, established here in 1885, occupies a fine building, which, with the high school and county courthouse and jail, is among the finest structures of the village. The water-works are owned by the municipality. Population, in 1890, 2062; in 1900, 3359.

HOUGHTON, George Hendrick (1820-97). An American Episcopal clergyman. He was born in Deerfield, Mass.; graduated at New York University in 1842, and at the General Theological Seminary in 1845. In 1848 he organized, and until his death was rector of the Church of the Transfiguration, better known as 'The Little Church Around the Corner,' in New York City. The story which explains the origin of this name is that a certain actor having died, his friends requested one of the city pastors to conduct the funeral services. The latter refused, but advised them to try the 'little church around the corner.' Dr. Houghton was distinguished for his activity in benevolent work. At his death he was succeeded by his nephew, George Clarke Houghton.

HOUGHTON, Henry Oscar (1823-95). An American publisher, born at Sutton, Vt. He graduated in 1846 at the University of Vermont, and worked in Boston as compositor and newspaper reporter. In 1849 he entered the Cambridge firm of Messrs. Bolles & Houghton, and in 1852, upon Mr. Bolles's retirement, transferred the office to its present site, and established the well-known Riverside Press. In 1872 he was elected Mayor of Cambridge. In 1878, by acquiring control of the large list of the old firm of Messrs. Ticknor & Fields, the Houghton house secured exclusive publication rights for the works of many leading American authors, such as Emerson, Longfellow, and Holmes. For many years *Webster's International Dictionary* has been printed by the Riverside Press.

HOUGHTON, hạ'ton *or* hou'ton, RICHARD MONCKTON MILNES, Lord. See MILNES, RICHARD MONCKTON.

HOUL'TON. A town and the county-seat of Aroostook County, Maine, 140 miles northeast of Bangor; on the Bangor and Aroostook and the Canadian Pacific railroads (Map: Maine, H 3). It is surrounded by a farming and lumbering district, and has considerable commercial importance. There are a foundry and machine-shops, saw, planing, and molding mills, woolen-mills, starch-factories, a flour-mill, a butter-factory, and a large slaughter-house. The town has a public library and the Ricker Classical Institute. The government is administered by town meetings. Population, in 1890, 4015; in 1900, 4686.

HOUMA, ho͞o'mȧ. A town and the parish-seat of Terrebonne Parish, La., 70 miles southwest of New Orleans; on the Bayou Terrebonne, and on the Southern Pacific Railroad (Map: Louisiana, E 4). It has several oyster-packing establishments, a large moss-factory, manufactures of sugar, molasses, and lumber, and considerable trade in rice and grain. Population, in 1890, 1280; in 1900, 3212.

HOUND (AS. *hund*, OHG. *hunt*, Ger. *Hund*, Goth. *hunds;* connected with Lat. *canis*, Gk. *κύων*, *kyōn*, OIr. *cú*, Lith. *szů*, Skt. *śvan*, dog). Broadly, the term 'hound' distinguishes hunting-dogs, who follow their animal quarry by scent, from the greyhound group, who hunt by sight; and also from the field dogs (q.v.).

Hounds, then, comprise the bloodhound or sleuth-hound, as he is still called in Scotland, the buck or stag hound, the foxhound, the otter-hound, the harrier, the beagle, the basset, and the Great Dane. The origin of all the breeds of hounds is the Talbot, or old Southern hound (*Canis sagax* of Linnæus), of which probably no true example exists to-day, although a few were preserved well up into the nineteenth century. These dogs were remarkable for their great size and strength, the depth of the chest, length of ears, and the breadth of the head in the region covering the olfactory nerves; hence their capacity for tracing the 'sleuth,' 'slot,' or track. Before the Christian Era the bloodhound or sleuth-hound of Great Britain had become so celebrated for these qualities that, as we know on the authority of Gratius, they were imported into Gaul. Strabo, who flourished somewhat later, confirms this, and Oppian praises their powers of scent and their courage.

THE BLOODHOUND. This hound is the nearest to the original Talbot, and for centuries was the hound of the huntsman whose quarry had to be followed by scent. During many centuries he was the principal agent in Europe in bringing the bear, the boar, and the stag to bay; but swifter breeds were gradually evolved, and the bloodhound's occupation dwindled to that of employing his extraordinary capacity to maintain a trail, however crossed and faint, in tracking human poachers to their hiding-places. Had it not been for this need, the breed would in all probability have entirely disappeared, as, in fact, it nearly had, when in the middle of the nineteenth century a few enthusiasts took up the breeding and restored the dog to his rightful position. The stories of carnage following the dog's overtaking man do not apply to the true bloodhound. When he has treed or fixed his man, he gives tongue and takes care that the pursued does not escape; but he will never lay hold viciously and maliciously. The bloodhound's practical use to-day is in tracking fugitives, refugees, and missing persons; and for this purpose packs of them are maintained by many public authorities. Their capacity to do this borders on the incredible; for, however the footsteps of the one sought for may be crossed by others, in country or street, the nose of this hound, once it has taken up the trail, will follow it. Running water is apparently the only medium that will baffle him. This sense is, of course, natural; but to develop it and bring the dog's use of it into subjection, and make it intelligently useful, the puppy has to be trained and his powers gradually extended and kept in practice.

The characteristics adopted as the standard by the American Bloodhound Club depict the modern dog. He should be from 25 to 27 inches high at the shoulder for dogs, and a little less for the other sex; in color, black and tan; the black, extending to the back, top of neck, and top of head, is, however, always more or less mixed with tan. The tan is a deep rich red; the coat should be short and hard on the body, but silky on the ears and top of head. The ears should be long enough to overlap each other when drawn down together in front of the dog's nose. The eyes should be hazel, deeply sunk, and with triangular lids, showing the third eyelid or 'haw.' The head should be large in all dimensions except width; the muzzle deep and square; the brows fairly prominent. The skin covering the forehead and cheeks is wrinkled, and the general expression of the whole head is majestic. The neck is long, to enable him to drop the head to the trail without altering his pace. The chest and ribs wide and deep, and the legs straight and muscular; the ankles of full size, and the feet round and cat-like.

THE FOXHOUND. As a breed distinctly characteristic and solely used for the hunting of the fox, the foxhound is a comparatively modern development, not reaching further back than two hundred years; but it has been developed from the bloodhound and the Talbot or old Southern hound, traceable for two thousand years. When England gradually became more or less deforested, and animals of the chase had more open spaces for their speed, it naturally followed that this dog had to have increased pace, and for all kinds of game except the very heaviest the bloodhound and Talbot gradually gave place to lighter hounds grafted on the old model. The stag or buck hound was the first variety of what we now class under the general term 'foxhound.' He was the first to come, and practically the first to go, for not one pack of the larger buckhound exists to every hundred packs of the true foxhound. The establishment of regular packs of hounds for hunting the fox, the first of which was the Pytchley in 1750, stamped the breed on the lines from which the English hound has never varied—indeed, into some packs not a single drop of extraneous blood has ever been introduced. Most of the packs established in the latter part of that century are still, so far as other blood is concerned, in unbroken existence; such are the Belvoir (founded, 1756), the Quorn, and the Cottesmores.

Where the game chased is as swift and crafty as the fox, and the country as open, yet studded with hedgerows and walls, which act as an ever-recurring screen from sight, it follows that the pursuing hound must have unfailing powers of scent, endurance, and swiftness. These are the three characteristics of the bony, muscular, compact, big-bodied, typical foxhound. His height is not so material as are other points; 23 to 24 inches at the shoulder is a safe medium. Nor is color imperative, though necessarily, from the jealousy with which the breed has been guarded, there are no variations outside the yellow or tan, black and white, in ever-varying and clearly marked blotches over the whole body. The head should have a girth in front of the ears of fully 16 inches; the nose should be 4½ inches long, and wide, with open nostrils, and ears set low and lying close to the cheeks. The neck should taper from the shoulders to the head. The chest of a dog 24 inches high should be more than 30 inches in girth, to give the necessary lung capacity, and the ribs must be deep and grade into the loins without an observable break. The hind quarters must be very strong, and the front legs straight and strong. So important are these two features that in judging they call for 20 points out of the total 100. The modern dog, being better trained, is lighter than his ancestor; 70 to 80 pounds is the limit of a dog's weight, and the female may be ten pounds lighter.

In America the local conditions differ so widely, and are so various, that it is almost impossible to define the American foxhound. In some districts, like Maryland and in the Genesee Valley, the fox is followed very much after the English fashion, on horseback, over rolling grasslands; elsewhere, the dog does the hunting and the man waits behind a wall on the supposed runway with a gun; in a third, the men follow the dogs afoot; in still others, they hunt the fox at night. It follows, therefore, that the dogs locally needed must be as various as the methods, and they are so; but, speaking broadly, and of the hound favored by the American Foxhound Club, it need only be said that it is bred on lighter and finer lines than its English ancestor. It is shorter at the shoulder—21 to 23½ inches—and weighs not more than 57 pounds. The chest is narrower in proportion to depth than the English standard; 20 inches in a 23½-inch hound is considered good. In most other respects, naturally the requirements are very similar. One minor point of some importance may be noticed: the English dog always has his ears artificially rounded, while the American dog retains them untrimmed.

The Harrier. From the earliest times the hare has been hunted by dogs. There is a cameo among the Greek gems which depicts him chased by his especial enemy, the long dog or greyhound; but he had an equally persistent foe in the old Southern hound, the immediate ancestor of the modern harrier. The original harriers must not be confused with the dwarf foxhound, which does duty as a harrier to-day. It was only after the draining and clearing of England and Ireland at the beginning of the nineteenth century, when, for the first time, the chase could be followed on horseback, that the old Sussex blue-mottled harrier, the first step in refining the old stock, came into fashion. The persistence with which a scent-hunted hare can be worried by dogs with good noses, and the sport it afforded to watch the tricks and subtleties of hare and hounds, made hare-hunting very popular. In order further to insure the needed qualities, the smaller foxhound strain was called into requisition, and 'Tyrant,' a sire from the Duke of Grafton's kennel, became the foundation of the pack of Sir John Dashwood King, of West Wycombe, whence the strain spread throughout Great Britain. There are still packs of the older and slower kind, however, and there is a 'standard of points,' but it is scarcely worth repeating here.

The Beagle. The harrier looks like a diminutive foxhound, and the beagle looks like a diminutive harrier; but he is not that. He has a most ancient lineage, and for beauty of form, gentleness of manner, sweetness of voice, and hunting qualities he has no equal. The length of the separate existence of the beagle has allowed opportunity for many varieties besides the 'rough' and the 'smooth.' A very pygmy breed called 'lap-dog beagle' was once popular. So small were one pack of these that the whole ten or twelve couples were carried to the field in a pair of panniers slung across a horse. Even the common-sized beagle is slow enough to allow any ordinarily active man to follow the chase afoot. There is a Beagle Club in America which sets the standard, and field trials are annually held under its auspices. Though diminutive, some classes not exceeding 15 inches, the beagle is every inch a dog, with a wiry frame and a determined, though placid, look. His standard of form closely follows that of the foxhound.

The Basset. This dog is the French equivalent of the English beagle, inasmuch as he is the diminutive of an ancient breed, and his quarry is the rabbit. In other respects, as the beagle follows the characteristics of the old Southern hound, the basset resembles their other ancient common ancestor, the bloodhound. His body is longer, and his legs even shorter than the beagle's. His head is long and narrow, with heavy flews, and his forehead wrinkled to the eyes, which, like the bloodhound's, show the haw; his expression is dignified; the neck is very powerful, with heavy dewlaps, and the ears so long he is likely to tread on them, for his legs are not more than four inches long. The stifles are bent, and the quarters full of muscle. He is very barrel-like, and has a character easily recognized.

The Dachshund. Except that this dog hunts rabbits, and, like the beagle and the basset, is short on the leg and long in the body, he has nothing in common with the others. He is a curious mixture. He has the smooth coat and body of a pointer, the tail and nose of a black and tan terrier, the ear of a foxhound, with more than the foxhound's sensitiveness, the hinder legs taller than the front ones, and the latter comically bowed. He is a very ancient breed. One of his kind is painted on an Egyptian monument of the period B.C. 2000. He has many modern admirers, and a club devoted to his interests, whose standard calls for a general appearance long, low, and graceful—not cloddy—a wedge-shaped head, long and lean, broadest at its base; skull moderately arched, bridge of nose somewhat curved or nearly straight, no stop; muzzle strong, not snipy, but fairly pointed, with open nostrils; ears medium, long, broad and soft, round at end, set on high and well back; eyes showing no white, and with keen expression; jaws strong, with strong and regular teeth; neck tapering from the shoulders to the head; shoulders well muscled and plastic; chest well developed, especially the breastbone; body long, back ribs very short; fore ribs well sprung; fore legs short and strong in bone; fore arms crooked; feet large, round, and strong; hind legs smaller in bone and higher than fore legs; lower thigh very short and forming nearly a right angle with the upper thigh; feet of hind legs smaller than those of fore legs; coat short (except on the wire-haired), dense, strong, and glossy, but short and fine on the under side of the body; skin loose and supple; color, red in all tints, black and tan, liver and tan, grey and tan, and spotted. White is objectionable, except in a small stripe from the breastbone (which is prominent) downward.

Turnspit. A dog closely akin in build to the dachshund, and called the bath-hound or turnspit, was used in England in some localities well into the nineteenth century to drive a wheel by which the roasting-spits were turned before the fire. He was put in a box in such a position that he could apply his fore feet one after another to a paddle-wheel, and by that means the spit went round. A similar dog, used for rabbiting, was early known to English hunters as the 'wry-legged terrier.'

The Otter-Hound. This is the gamiest and pluckiest of dogs. His prime requisite is such hardihood as will enable him to follow the otter to its water den and fight him there, withstanding without complaint the severest bites from this most vicious of animals. If fish are to be 'preserved' in certain streams, otters must be limited, and to this end otter-hounds are a necessity. This dog must have powerful jaws and good teeth, also a rough grizzly coat, which defies alike the chill of the water and the teeth of the otter. Beneath the wiry outer coat, an under coat of oily wool is essential. This hound is a large dog, standing about 25 inches high, and weighing 50 to 75 pounds.

The Great Dane, or German Boarhound. This is the last visible remnant of one of the two great classes into which dogs were divided by Xenophon and the early Greek writers—the 'fighting dogs,' famed for their huge frame, their pugnacity and ferocity under training. Most of the ancient nations cultivated this dog as an ally in their armies. Arrian enumerates those of "the Mede, Celt, Ser or Indian, Albanian, Iberian, Lycaonian, Libyan, Egyptian, Magnesian, Molossian, Briton, Arcanian, and a few others nearly allied." Cyrus had his war-dogs, and at Marathon dogs shared the honors of the day. That their use was continued by the Romans is evidenced by the fact that from the ruins of Herculaneum have been exhumed the calcined corpses of dogs wearing mail armor. The use of this huge dog for aggressive pugnacity has long since passed, but as a companion and safeguard he has always been valued by German game wardens.

The standard adopted by the Great Dane Club of America maintains all the great and marked qualities of this giant of the canine world, decreeing for dogs a minimum height of 30 inches and a weight of 100 pounds, with an approximate height of 32 inches and a weight of 140 pounds. It requires a powerful and elegant brute. The body must be long, round, and compact; the coat short and fine; the ears small and carried high; the eyes small, deeply set, and with a sharp expression. The recognized colors are the various shades of gray or blue, mouse color, black, white, red or fawn; also brindle or tiger-striped or white ground, with patches of dark colors.

The Mastiff. This dog (the *Canis Anglicus* of Linnæus) is a true hound, and undoubtedly is of British origin, for he was exported from there before the Roman conquest of the islands. He was used by the Britons as a guard-dog for their persons and their flocks, more than in the hunt; and he remains preëminently *the* watch-dog of the present day. Watching has become almost instinctive with him. He is the largest and most muscular dog known, exceeding even the Great Dane, and has the courage of the bulldog, yet withal is so gentle that he is the especial favorite of children. In color he is apricot, or silver fawn, or dark fawn brindle, with the muzzle, ears and nose black in all cases; his coat is short and close-lying; his head is a very ideal of strength and massiveness, and it is set on a neck and chest in proportion. No height is set in the standard, but a dog which must weigh from 155 to 175 pounds should be very little under three feet tall.

Bibliography. Consult authorities mentioned under Dog.

HOUND. A small shark. A name more common in Great Britain than in America for the 'dogfish' of the genus Mustelus, especially the blue or 'smooth' hound (*Mustelus canis*), common to both sides of the Atlantic. See Dogfish.

HOUNDFISH. (1) A needle-fish, especially *Tylosorus raphidoma*, also called 'guardfish.' See Needlefish, and Plate of Needlefish, Pikes, etc. (2) A dogfish.

HOUND, HOUNDING. A hound is a dog employed in the chase; specifically, in England, one adapted to fox-hunting. Hounding is the pursuit of game by hounds. The keeping of hounds and the sport of hounding are, to a greater or less extent, regulated by law. Those who follow hounds in fox-hunting, in England, are exempt to some extent from the common-law liability of other trespassers, such sport ranking as a privileged pursuit. The employment of hounds in deer-hunting is prohibited by statute in some of our States. Fox-hunting with hounds, however, is becoming popular in certain parts of this country. Consult Peer, *Cross Country with Horse and Hounds* (New York, 1902), and the authorities referred to under Game Laws.

HOUND'S-TONGUE (so called from the appearance of the flowers), *Cynoglossum*. A genus of coarse-appearing, small-flowered plants of the natural order Boragineæ, of which there are many species. The common hound's-tongue (*Cynoglossum officinale*) is a native of Europe, Asia, and Africa introduced in North America. It has soft downy leaves, of a dull-green color, purplish-red flowers, and a stem about two feet high. Its odor is very disagreeable. The root was formerly administered in scrofula, dysentery, etc., and is said to be anodyne. It is also one of the pretended specifics for serpent-bites and hydrophobia. The hound's-tongue is considered a pernicious weed on account of its burs, which adhere to the wool of sheep and to other animals. *Cynoglossum Virginianum,* known as wild comfrey, is a common plant from Canada to Florida. The species of Echinospermum, formerly united with Cynoglossum, are weeds, Echinospermum being the beggar's lice or stick-tights. The quality of sheep's wool is often considerably lowered from the abundance of their burs in it.

HOUNSLOW HEATH. A region west of the township of Hounslow, London, covering in 1546 an extent of 4293 acres. It was formerly notorious as the resort of highwaymen, and it was customary to leave the bodies of those who had been executed hanging on gibbets along the road. In 1686 James II. established a camp on the Heath for the purpose of overawing the Londoners. Extensive barracks were erected in 1793, and part of the land is now occupied by powder-mills. The region is in great part under cultivation and inclosed.

HOUR (AF. *ure,* OF. *ure, hure, ore, hore,* Fr. *heure,* from Lat. *hora,* from Gk. *ὥρα,* hour, season). A measure of time equal to one twenty-fourth part of a day (q.v.). As there are two kinds of days, the solar and sidereal, so there are two kinds of hours, the solar and sidereal. The latter is shorter than the former by 9.856 solar seconds. Sidereal time is used by astronomers in discussing the motions of the stars; but in the ordinary affairs of life solar time only is employed. Twenty-four ordinary solar hours correspond to an interval of time equal to the mean or average period elapsing between two successive returns of the sun to any given meridian. The first hour of the civil or ordinary day is numbered XII, and commences at midnight. The following hours are then numbered I, II, etc., up to XII, which number is attached to the hour beginning at noon. In Italy, until November, 1893, when the standard time was adopted, time was reckoned from sunset continuously, from 1 to 24 hours. On the Continent, France is to-day the only country that is outside the time-zone, i.e. that uses local time.

HOUR-GLASS. An instrument for measuring intervals of time. It is made of glass, and consists of two bulbs united by a narrow neck; one of the bulbs is nearly filled with dry sand, fine enough to run freely through the orifice in the neck, and the quantity of sand is just as much as can run through the orifice in an hour, if the instrument is to be an hour-glass; in a minute, if a minute-glass, etc. The obvious defects of this instrument are the expansion or contraction of the orifice produced by heat or cold, and the variations in the dryness of the sand, all of which produce deviations from the true measurement of time. Instruments constructed on this principle are still used by navigators in 'heaving the log,' for the purpose of measuring the time during which the log-line is allowed to run out. Similar instruments are also employed by cooks in fixing the proper time for boiling eggs.

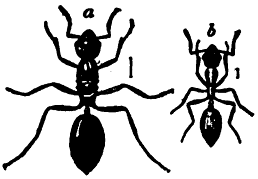
HOURI, hou'rĭ (Ar. *ḥawrâ,* woman with bright black eyes, from *ḥawira,* to have brilliant black eyes). The beautiful celestial maidens, described in the Koran (Sura lvi. 24; lv. 55; et al.) and Mohammedan tradition as dwelling in Paradise, whose companionship is one of the rewards held out to the pious Mussulman. Numerous descriptions amplifying the notices in the Koran are found in Mohammedan writers. They repose on gorgeous couches in pavilions of pearl. Their countenances are so bright one can see his face reflected from a houri's cheek. They are made by 'a peculiar creation,' not of clay, like ordinary women, but of musk, saffron, incense, and amber. While retaining all the qualities of virgins, they have none of the failings of women, remain ever young and free from physical defect, and have the power to conceive and bear children at will, who within an hour grow to maturity. The later Mohammedan theologians, like Ghazali (q.v.), whose more refined instincts were offended by this rather sensual picture of Paradise, endeavored to place an allegorical interpretation upon the houri; but there can be little doubt that to Mohammed and to his immediate followers, as to the bulk of present-day Mohammedans, they represent an intense reality. This follows from the details of the houri given by Mohammed and amplified by subsequent writers, on the basis of tradition, which accord with the general view of Paradise as a place where life will be full of secret delights, where there will be plenty of water, delicious fruits, with attendants waiting on the pleasure of the inhabitants, and the like. Mohammed's conception of Paradise, while based in part on the current Jewish, and more particularly Christian views, embodies as its original factors the adaptation of these views to his own mental horizon and to that of his surroundings; and one is inclined to conjecture that the houri represent the reverse of the popular conception of demoniac beings, frequently pictured as female spirits, who plague and torture man in this world.

HOURS, in mythology. See HORÆ.

HOURS OF LABOR. See LABOR LEGISLATION.

HOUSATONIC, hōō'sȧ-tŏn'ĭk. A river of New England, rising in the Berkshire Hills, Massachusetts, and flowing south through Connecticut (Map: Connecticut, C 4). It empties into Long Island Sound, four miles east of Bridgeport, after a course of 150 miles through a region full of wild and beautiful scenery. It supplies water-power to numerous manufactories.

HOUSE-ANT. The little red ant of households (*Monomorium Pharaonis*), a species which has accommodated itself perfectly to the conditions of civilization. It nests in the walls of houses or in rubbish in cellars or old closets, and feeds on all sorts of household stores. It becomes a great nuisance, not so much from the amount it eats as from its inordinate propensity for getting into things, especially sugar, syrup, and sweet substances generally. Careful watching will sometimes reveal the crack from which most of them come, and the nest may thus be found and destroyed. They may be trapped by thousands by a sponge moistened with sweetened water, which is daily relieved of its burden of ants by plunging it into scalding water. The cracks by which the ants enter storerooms and pantries may be plugged with cotton soaked with kerosene, or



RED HOUSE-ANT.

a, female; *b,* worker; in relative proportions.

the entire house may be fumigated with bisulphide of carbon or hydrocyanic acid gas. Directions for such fumigation are printed in circular form by the Department of Agriculture at Washington and are sent to all applicants free of charge. Two little black ants (*Monomorium minutum* and *Tetramorium cæspitum*) are also found in houses, but nest outside. Consult Howard and Marlatt, *Household Insects* (Department of Agriculture, Washington, 1896).

HOUSEBOATING. The passing of the summer-time, as a recreation, on what really is a flat-bottomed raft supporting a more or less extensive and luxurious suite of rooms, occupying the centre of the raft. At each end of the house is an open deck, and an open gallery along the sides; the top, which is railed round and covered by an awning, forms an open court or garden. There are endless varieties in design, but this general description substantially covers the characteristics of most modern houseboats. This manner of passing the summer holidays began about 1870 on the Thames. To-day a hundred houseboats are to be found on it, and a regular weekly paper is published, which gives the whereabouts of every such boat from day to day. Some of these boats are models of beauty in decorations and fittings, and veritable floating palaces of luxury and fashion. They are either poled from point to point, or towed from the path by a horse, or else tugged by an auxiliary launch. The proximity of riverside villages and inns precludes the necessity of giving up much of the internal space to stores. American conditions are so different as to need a much greater variety of treatment, and in every section of the country houseboating is popular. Houseboats are abundant on the Pacific Coast, and the Mississippi system is dotted with them wherever a great city forms the necessary social nucleus. On the Saint Lawrence and the Lakes George and Champlain they are a summer feature, and the neighborhood of New York is especially favorable to them. In the Florida waters are some of the largest ever built, as well as many of the humbler and truer kind.

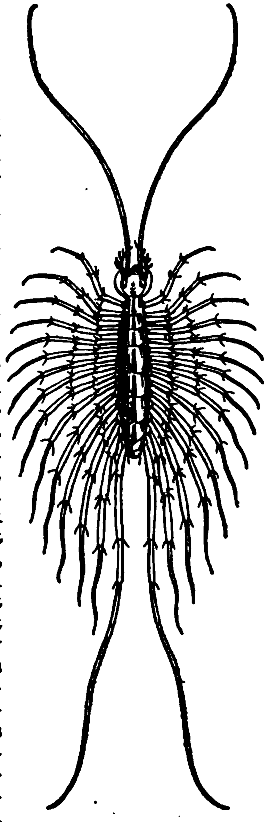
For convenience of description, houseboats may be divided into four classes, according as they (1) simply float, and are moored to stay; (2) are meant to move from place to place, but have no power; (3) carry their own sails; or (4) are propelled by their own engines. Within these divisions every kind of craft is in service. There is the *Alameda*, a converted 85-foot schooner, which can cruise by sail or steam, and the *Caiman*, a double-decker, 97 feet long, capable of navigating with her own steam power the inlets and inland waters of Florida. Scarcely less pretentious are the *Idler* and the *Wanderer*, designed especially for the shallow rivers of the upper Mississippi Valley. Among sailing houseboats there are the *Sommerheim*, 70x20, on which a house 30x16 is carried, and the *Nautilus*, with a deckhouse constructed of four abandoned street cars. Others are floating studios, like *Dragon*, 30x16; and *Outing*, built for the waters inside the keys of the Jersey coast, a roomy sloop-rigged houseboat 35x11 and 13 inches draught; hunting-boxes, like the *Ruth*, with her house sunk level with her deck, for use in duck-shooting; and broad-beamed rafts, like the *Belvidere*, of which half a hundred may be found in San Francisco Bay and its tributaries.

An ordinary flat-boat, without power, except some simple sails, steered by a rudder, and carrying a house of Georgia pine, can be built (home-made) or purchased anywhere for from $300 to $800. Practical working designs and instructions for building will be found in articles by Norton in *Outing* for July (New York, 1892) and August (New York, 1900).

HOUSEBOTE (from *house* + ME. *bote*, AS. *bōt*, Goth. *bōta*, OHG. *buoza*, Ger. *Busse*, recompense, atonement). At common law, the right of a tenant for life or years to cut and take from the premises occupied by him sufficient wood for repairing the house and other buildings on the estate and for use as fuel, without becoming liable for waste. It belongs to the class of tenants' rights known as estovers. See ESTOVER.

HOUSEBREAKING. See BURGLARY.

HOUSE CENTIPEDE. A myriapod with very long legs and long antennæ, which is numerous in the Southern States, and brightly colored. It haunts houses and is feared by ignorant persons as poisonous, but is harmless and really beneficial, as it feeds on small insect vermin. It is the only representative in this country of the chilopodous family Cermatiidæ, and is named *Scutigera forceps*. Consult Marlatt, *Household Insects* (Washington, 1896). See MYRIAPODA.



HOUSE CENTIPEDE.

HOUSE-CRICKET. See CRICKET.

HOUSE-FINCH, or LINNET. A small finch (*Carpodacus frontalis*) very common throughout California, Arizona, and Northern Mexico, and familiar in all valley towns and rural gardens, where it is welcome for its beautiful plumage and exceedingly sweet, canary-like song, heard throughout the year. It is related to and resembles the purple finch of the Eastern States, but is smaller and trimmer. The head and breast of the male are a rich red-wine color, varying from carmine to crimson, and the remainder of its plumage a mixture of reds, soft grays, and browns; the females and young have no red, and in winter the colors are less bright than in early summer. This finch makes its nest normally in trees, but now also occupies holes and crannies about houses and buildings, where it is never disturbed by the people, although much harassed by swallows in competition for desirable quarters. The eggs are pale blue, sparingly marked with dark lines and dots about the large end. Other names for this bird are 'adobe finch,' 'red-headed linnet,' and 'burion.'

HOUSE-FLY. The most common and familiar fly of civilization (*Musca domestica*), the type of the family Muscidæ (see FLY). It is remarkable for its extensive geographic distribution, and is found practically in every spot where man has been. It is a very rapid breeder and swarms in enormous numbers during the summer and in warm regions. Its eggs for the most part are laid in horse-manure, and it is safe to say that more than 90 per cent. of the house-flies in America to-day were reared from horse-manure. In the absence of this substance, however, they will breed in cow-dung, in decaying vegetation, and in privies. The eggs are small, slender, and white in color, and in summer-time hatch in four or five hours. The larvæ become full grown in three days, and the pupa stage lasts only three to five days. The total life-round of a generation may be as short as seven or eight days. Each female lays about 150 eggs, and this prolificness and rapidity of breeding, taken in connection with the general abundance of larval food, readily accounts for the enormous numbers of flies which infest dwellings.

The house-fly is undoubtedly an important factor in the spread of certain diseases, especially enteric fevers and cholera, as it may breed in human excreta and afterwards visit food-supplies or dining-tables. The best remedy is the exercise of great care and cleanliness. Stables where horses are kept should be cleaned every day or so. The manure should be put in a close room or pit, and each day's additions should be sprinkled over with a shovelful of chloride of lime.

HOUSEHOLD, ROYAL (of Great Britain). The personal attendants upon the reigning sovereign. Among all primitive Germanic peoples we find such attendants. The chief officers of the household are usually four in number: the steward, who is the head of the household; the marshal, or head of the royal stables; the cupbearer; and the chamberlain, who has charge of the King's chambers. These four officers are found among the Anglo-Saxons and at the Court of the Norman dukes. As the royal power developed, the household attendants became officers of state, and the King's household is his ministry. Under the Norman kings of England the royal household consisted of two sets of officers, whose functions greatly resembled each other. Foremost among them was the justiciar, the King's chief adviser and his representative in England when the King was abroad. The steward, whose most important functions of state passed over to the justiciar, remained head of the royal household. Other members were the treasurer, who had charge of the King's treasury, and the chamberlain, who audited the accounts; the constable, a sort of quartermaster-general of the Court and the army, who had a seat in the exchequer, and the marshal, whose functions were similar. Some of these officers, viz. the steward, the constable, butler and marshal, were hereditary in the great Norman families, and either lost their importance or became merely household officers. Others which were appointed, like the justiciar, chancellor, and treasurer, became the important officers of state.

In the present organization of the royal household the lord steward is the chief officer. His authority extends over the treasurer, the controller and the master of the household, and over all the other household officers and servants except those of the chapel, the chamber, and the stable. The dean and the subdean are the principal officers of the chapel, which is composed of a number of clerks and chaplains. The lord chamberlain controls the officers and servants of the royal chambers, and appoints the tradesmen who are purveyors to the sovereign. The master of the horse is in charge of the royal stables, and has under his charge the master of the hounds, the grand falconer, the crown equerry, and other servants. In the court of a female sovereign the ladies of the household play an important part. The mistress of the robes is the head of this department, and under her are the ladies of the bedchamber, maids of honor, and other attendants. The ladies of the bedchamber are the personal attendants of the Queen. Besides these there are a large number of physicians, surgeons, apothecaries, druggists, and dentists in attendance. The other members of the royal family have similar households, but on a much smaller scale.

The expenses connected with the royal household have varied greatly in the different periods of English history. In the Middle Ages the King was always attended by a large following of lords, both spiritual and temporal, besides knights, esquires, and other inferior attendants. He obtained provisions for his Court by exercising the right of PURVEYANCE (q.v.), which has been abolished. Notwithstanding this, the expenses of the royal household often proved a burden to Parliament, which sometimes regulated them. This was most carefully done in the *Household Book* of Edward IV., which rigorously defined the officers of the household and the duties of its members. The expenses of the household of Edward IV. were £13,000 a year, which may be taken as a fair average sum for the household expenses of a king during that period. Since the accession of William III., Parliament has fixed the amount of the appropriation at the beginning of each reign. Queen Victoria received an allowance of £385,000 a year, distributed as follows: Privy purse, £60,000; household salaries and retired allowances, £131,260; household expenses, £172,500; royal bounty, arms and special services, £13,200; leaving an unappropriated balance of £8040, to be used at discretion. The Prince of Wales received an annuity of £40,000 over and above his other revenues, the Duke of Connaught £25,000, and the other members of the royal family in proportion to their rank. By a grant of May 9, 1901, Parliament increased the civil list to £415,000 for Edward VII., the King's privy purse being increased to £110,000.

For the early period consult: Kemble, *Saxons in England*, vol. iii. (London, 1886); Stubbs, *Constitutional History of England*, vol. i. (6th ed., Oxford, 1897); *The Ordinances and Regulations for the Government of the Royal Household* were published by the Society of Antiquaries (London, 1790); Lindsay, *The Royal Household* (London, 1898).

HOUSEHOLD GODS (Lat. *di familiares*, or *domestici*). Among the ancient Romans, the divinities supposed to preside and watch over the house and the family. Thus Vesta was the goddess of the hearth and guardian of domestic unity. But the name was applied especially to the *lares* and *penates*, spirits of the deceased ancestors under whose beneficent care the household prospered. The *lares* had special charge of the members of the family, and the *penates* of the dwelling; and they were worshiped at the *lararium*, or family shrine, which stood in the *atrium*, or central hall.

HOUSEHOLD SUFFRAGE. The form of the Parliamentary franchise at present in force in Great Britain. It was established in the boroughs by the Reform Bill of 1867-68, which conferred the right of voting for members of Parliament on all adult male household owners or lodgers who were the occupants of a dwelling capable of bringing in a yearly rental of £10 and over. By the Franchise Bill of 1884 the right was extended to the inhabitants of the counties who possessed the same qualifications.

HOUSEHOLD TROOPS. Specifically, the term applies to those regiments of the British Army which form the permanent garrison of the city of London, and whose especial duty it is to attend the sovereign. Details from these troops mount guard over the royal residences and important public buildings and institutions. The term includes the following troops: Two regiments of the Life Guards (First and Second); the Royal Horse Guards; the first, second, and third battalions of Grenadier Guards; the first and second battalions of Coldstream Guards; the first and second battalions of Scots Guards; and the Irish Guards. The term household troops is frequently used by English and American writers to describe the élite regiments of Germany and other monarchical countries.

HOUSEHOLD WORDS. A weekly periodical founded March 30, 1849, by Charles Dickens, who became its chief editor. The opening numbers contained a serial story by Mrs. Gaskell. *Hard Times*. and many of Dickens's minor stories, first appeared in it. It was discontinued in 1858, and was succeeded by *All the Year Round* (April 30, 1859).

HOUSE INDUSTRY. A form of industrial organization in which the workman labors at home for a manufacturer or contractor. It is to be contrasted, on the one hand, with the artisan organization of industry in which the master craftsman was his own business manager and produced for the needs of a local market, and, on the other, with the factory organization with its groups of workmen coöperating under a common direction and division of labor. Historically it forms a transition from the former to the latter. It was the outgrowth of a widening market for goods, and marked a change in the mercantile organization of industry which kept pace with and in many cases outstripped its technical progress. As a dominant form of organization it marked especially the closing years of the eighteenth and early years of the nineteenth centuries, and while it still lingers in backward regions, and even grows up anew under peculiarly favorable circumstances, it is in the main a thing of the past.

The characteristics of the system are the isolation of the worker's production by the crude processes of hand labor, and the marketing of the product by third persons. The workman may in the first instance supply his materials, but the need of uniformity in the product soon brings it about that the latter are supplied to him and he is paid at piece rates for the work he does upon them.

Such an organization can compete with factories only when the technical processes of production remain comparatively primitive. When complicated machinery and minute subdivision of labor is introduced into factory work, house industry is doomed. It has under such circumstances kept up for a time an unequal struggle in which long hours of labor and the assistance of the entire family marked the labor in the homes. Bad as were the conditions in the factories of England in the early part of the last century, their misery was exceeded by that of the poor hand workers with whom the factories competed.

The modern counterpart of house industry in Great Britain and America is found in the sweating system. This is confined to the garment trade, in which the mercantile transformation was later than in other lines of industry, and in which the relative scope of hand labor as compared with use of machines is very large. The textile industries and the manufacture of boots and shoes both passed through this stage. While spinning-machines and power-looms were yet primitive, the hand workers were able to maintain themselves for a while by working for others. In New England the factory system had its beginnings in the domestic occupations of the people. Throughout northeastern Massachusetts may still be seen about the farms ruins of small workshops where during the winter the farmers made shoes for the merchants of Lynn and Boston. Elsewhere in the State, straw for the manufacture of hats was plaited by the women on the farms, and by men, in the winter-time. In Sweden and Russia such industrial occupation among the rural population is quite frequent. In Central Europe house industry is far more extensive. The hilly region of Central Germany, from the Thuringian to the Silesian mountains, is its peculiar home. See SWEATING SYSTEM.

HOUSELEEK, or LIVE-FOREVER (*Sempervivum*). A genus of plants of the natural order Crassulaceæ, the members of which have the petals equal in number to the sepals, and inserted in the base of the calyx; the leaves are generally very succulent, and form close rosettes. The common houseleek, or cyphel (*Sempervivum tectorum*), grows wild on the rocks of the Alps, but has long been common in almost every part of Europe, planted on walls, roofs of cottages, etc. It sends up leafy flowering stems of six to twelve inches in height, which bear branches of pale-red star-like flowers, equally curious and beautiful. The leaves cut or bruised, and applied to burns, insect-stings, ulcers, and inflamed sores, afford immediate relief. They were formerly in high esteem as a remedy for fevers and other diseases, and an edict of Charlemagne contributed greatly to the extensive distribution of the plant. Other species possess similar properties. *Sempervivum globiferum*, with yellowish-green flowers, is very frequently planted on walls in Germany. Some of the species, natives of the south of Europe, the Canary Isles, etc., are shrubby; others are common greenhouse plants.

HOUSEMAID'S KNEE. A term commonly applied to an acute inflammation of the bursa or sac that intervenes between the patella, or kneepan, and the skin. Housemaids are especially liable to it from their kneeling on hard surfaces. It causes considerable pain, swelling, and febrile disturbance. The only disease for which it can be mistaken is acute inflammation of the synovial membrane lining the cavity of the joint; but in this disease the patella is thrown forward, and the swelling is at the sides, while in housemaid's knee the swelling is very superficial, and is in front of the patella. The treatment consists essentially in the employment of rest, cold applications, and bandaging. Where the condition has become chronic, radical relief can be secured by the excision of the bursa, or the injection of iodine. If suppuration occurs, the sac must be opened and the pus evacuated.

HOUSE-MARTIN. See HOUSE-SWALLOW.

HOUSE OF COMMONS. See GREAT BRITAIN, section *Government*.

HOUSE OF CORRECTION. See REFORMATORIES.

HOUSE OF FAME, THE. A poem by Chaucer, in three books, probably written in 1384. The influence of Dante is evident in the construction of the poem, which tells first of the poet's dream of the glass temple of Venus, a direct suggestion from Vergil; next, his flight on an eagle to the House of Fame, where names of great men were written on walls of ice, and awards were made by the goddess of fame to claimants in the presence of the poet.

HOUSE OF KEYS. See MAN, ISLE OF.

HOUSE OF LIFE, THE. A century of sonnets by Dante Gabriel Rosetti, published among the *Ballads and Sonnets* in 1881. Some of the poems were reprints from the *Poems* of 1870.

HOUSE OF LORDS. See GREAT BRITAIN, section *Government*.

HOUSE OF THE FAUN (It. *Casa del Fauno*). One of the largest and finest houses of Pompeii, famous for its elaborate decorations. In it was discovered the statue of the "Dancing Faun," from which the house received its name. Its mosaics are the most beautiful that have been preserved to the present day. Among them, occupying the floor of the exedra, was discovered the celebrated mosaic of the Battle of Issus, showing Darius fleeing from Alexander, now in the Naples Museum, where the other mosaics belonging to the House of the Faun are also preserved. These include a representation of the creatures of the Nile, which formed the threshold to the Battle of Issus; the Genius of Autumn riding on a panther, doves pulling a necklace out of a jewel-box, and other compositions.

HOUSE OF THE SEVEN GABLES, THE. A novel by Nathaniel Hawthorne, published in 1851. It is the story of a decayed New England family, and deals with the heritage of evil which has been passed down to an inoffensive generation. The leading character, Hepzibah Pyncheon, a spinster, is obliged, in her old age, to open a toy-shop in the old homestead.

HOUSE-SNAKE. See MILK-SNAKE.

HOUSE, or 'ENGLISH,' SPARROW. This typical sparrow (*Pyrgita domestica*) is the most familiar fringilline bird of Europe, and latterly of the whole civilized world. It is indigenous to Europe and Asia, where it is only partly migratory, and a constant attendant upon mankind. It was not known south of the Sahara, nor in Australasia, until the European colonization of those regions caused its introduction there; and since 1850 it has become a resident of both North and South America. Everywhere it flourishes, increases with amazing rapidity, and impresses itself upon the locality by its adaptability, and pugnacity toward native birds. From the earliest times it has associated fearlessly with mankind, and has been a denizen of towns more than of the country. This characteristic is most prominent in the new countries, where it clings at first to cities, and later spreads along railroads and other highways to the interior towns. It remains everywhere a town bird, rarely visiting, and never nesting in, the wilderness. To this urban habit is due in large measure its extraordinary hardihood and prolificacy, for in town it can always find an abundance of food in the streets, or about warehouses, railroads, etc. Consequently it is nearly independent of season in breeding, and may rear several broods a year; moreover, its nests and fledgelings are safe against nearly all the enemies and dangers which beset the lives of wild birds. The result is a longevity and a rapidity of multiplication which may speedily render the species a serious local nuisance. This is felt in the more populous parts of the Old World, as well as in the countries to which it has been transplanted, and where it flourishes with aggressive vigor.

While the sparrow seems able to eat all sorts of food, it is naturally graminivorous, and only when young, or in feeding its young, does this species consume insects in any considerable quantity. Its services to agriculture in this way are so limited in time and amount that they are insignificant, and more than overbalanced by its incessant attacks upon the smaller insect-eating birds, which otherwise would come freely about villages, orchards, and farmhouses. In the United States it has greatly lessened the number of such birds in some localities, or at any rate has driven them away from villages and farmsteads—particularly bluebirds, wrens, and all sorts of swallows, whose nests it destroys or appropriates; but there is reason to believe that the native birds are learning more and more how to cope with this bandit. Moreover, in some districts, besides great destruction wrought to the buds of fruit-trees, the sparrows annually migrate in summer in large companies to the grain-fields, and devour or shake down quantities of ripening grain. A third evil attributed to this bird is the spread of disease, due to its propensity for using feathers and rags in the construction of the nest, and for placing this nest upon or as near as possible to the house; since it may, and frequently does, gather these materials from infected clothing or bedding thrown out of sick-rooms.

INTRODUCTION INTO AMERICA. The house-sparrow was first brought to the United States from England in 1850 by Nicholas Pike and other directors of the Brooklyn Institute, when eight pairs were liberated in Brooklyn, N. Y.; but a second importation in 1853 was needed to establish the race. Sparrows were brought in and colonized elsewhere during the next twenty years, in various parts of the country, including California, the city government of Philadelphia importing and letting loose in that city over 1000 pairs in 1869. The motive in most cases was to free the shade-trees of devastating caterpillars, which about that time were especially numerous and annoying throughout the Eastern States. A few far-seeing persons protested, but were not listened to. Only a few years elapsed, however, before a mass of evidence was presented that the sparrows were of no practical service as insect-destroyers, and were an increasing nuisance and menace. The outcome of much discussion and writing was an exhaustive inquiry, conducted by the United States Department of Agriculture, the results of which, unfavorable to the bird, were published in 1889 in *Bulletin No. 1*, of the Department, a document of 400 pages. Whether, as many believe, a balance will after a time be obtained, and these imported sparrows cease to be relatively more numerous and troublesome than native birds of the same nature, remains to be seen. The fact that the people of Great Britain make the same complaint as the United States against their prolificacy and destructiveness discourages this expectation.

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HOUSE-SWALLOW, or HOUSE-MARTIN. The English name of the familiar European swallow (*Hirundo rustica*), which makes its mud nest about houses and barns, more often than otherwise in the interstices of farmhouse chimneys, so that it is also called 'chimney-swallow' (q.v.). It is widely distributed throughout the Old World, and everywhere a familiar of civilization. See SWALLOW, and Plate of SWALLOWS.

HOUSE TAX. In England, as early as 1428, a tax was levied on houses; but the practice was soon dropped and did not reappear until 1696, when it was introduced in imitation of a similar tax then existing in Holland. In the latter year a fixed tax of two shillings was levied on all houses, with a higher rate for those which had more than a specified number of windows, on the theory that in this way occupants could be taxed in proportion to their means. With certain modifications as to rate, this tax continued to be levied until 1778, when it was changed to a tax on inhabited houses, proportioned to the rental value, again in imitation of the Dutch practice. The tax was repealed in 1834, but was renewed in 1851, and is still in force. At present houses of less than £20 rental value are exempt; the tax is graduated up to £60. The theory of the tax on houses is that expenditure for house-rent is one of the best available tests of income. The tax is, however, unpopular and unproductive, and for these reasons does not find a place in the fiscal systems of other modern States.

HOUSE THAT JACK BUILT, THE. A nursery rhyme in *Mother Goose.* It relies for its interest on the accumulative manner in which it is told. Hallowell conjectures that its original was a Chaldean hymn or fable, in *Sepher Haggadah*, which is strikingly like the rhyme of *The Old Woman and the Crooked Sixpence.*

HOUSING PROBLEM. The increase of crowded tenements and unsanitary slum districts which resulted from the rapid growth of cities in the latter half of the nineteenth century aroused the philanthropist and the public to the realization that they must solve the problem of housing the working classes and the poor. In view of the fact that much emphasis is placed upon the characteristic feature of American architecture—the middle-class home with its many comforts and conveniences—the housing problem as a question of environment for the individual is taking on larger proportions than a mere tenement-house reform. Comfortable housing involves questions of heat, light, sanitation, and conveniences, better facilities for which the increased production and the inventions of the nineteenth century are continually putting within reach of the masses. In small cities, in rural industrial centres, and especially in the expanding suburbs, the kind of housing facilities provided are recognized as an important element in the standard of living.

Previous to the nineteenth century little attention was paid to the homes of the common people. Ancient and mediæval history tells of great personalities, and we possess to-day tombs and temples, palaces and arches, churches and castles, as relics of the past civilization; but the daily life of the people is not recorded, and has passed away with the rude hovels and noisome dens in which they herded. Southern nations easily adapted their dwellings to the climate, although extreme squalor frequently existed. Real comfort, however, was unknown to the northern nations until the great merchant princes introduced into Europe the conveniences familiar to southern potentates. The means by which modern life is made comfortable are the distinctive features of Western civilization, especially of the United States; but certain conditions have prevented the working classes from sharing these benefits. The workman must live near his work. The demand for property in the centre of cities for business purposes has increased the value of the land, and also lessened the amount available for homes for the workers. As the demand for dwellings exceeded the supply, it became profitable to subdivide and sublet old mansions, stores, or cottages built when the city was a country town. These buildings became entombed in blocks of buildings, with no provisions for ventilation, sanitation, or conveniences, and often one hydrant supplied a whole house with water. As the demand increased, the rents rose and more people were crowded into a few rooms. Forty per cent. is said to have been an average return on such property, upon which no repairs were made. To reap this harvest, badly constructed buildings were erected, often by ex-tenants who recognized the opportunity to make money. All available space was used. Back-to-back cottages were put on the same lot. The worst type of tenement is the 'double-decker dumb-bell,' peculiar to New York. In English manufacturing towns, small cottages—rows upon rows in narrow alleys—were built on leased land. No unnecessary expenditures were made, as the houses were intended to fall when the lease expired. (Consult Engels, *The Condition of the Working Class in England in 1844.*) Damp cellars, dark halls, vermin, filth, lack of repair, no ventilation or adequate water-supply are characteristic of all slum dwellings. Not only does a whole family often occupy one room, but sometimes several families. Boarders are taken to help pay exorbitant rents, and the rooms are rented in the daytime for manufacturing purposes. The mortality in such dwellings is very high, the prevailing diseases being typhoid fever, diarrhœa, and all contagious diseases. Tuberculosis is characteristic of the tenement.

For the individual, bad housing means uncleanliness, sickness, lack of privacy, and often contact with criminals and prostitutes. This causes the corruption of the young, lack of self-respect, discouragement, intemperance, and low morality. In New York City it was estimated that out of a population of 255,033 only 306 had access to a bath. Ordinarily the most primitive provisions for cleanliness are lacking. Home life, with normal parental and marital relations, is impossible. Furthermore, every working man and woman loses, on an average, twenty days a year on account of sickness. Economists are agreed that where more than 20 per cent. of the income of the head of a family goes for rent, as is often the case among the poor, privations must be endured along other lines of consumption, especially in food. The districts where overcrowding and bad housing prevail are centres of crime, vice, and epidemics, and impose upon society not only a large bill for the maintenance of hospitals, almshouses, and prisons, but greatly lessen production through the inefficiency of workers. It is estimated that the working population of England between the ages of fifteen and sixty-five lose 20,000,000 weeks in a year. To this loss in working time must be added the inferior quality of the work of people enfeebled in mind and body by poor food and unsanitary homes.

In England the housing question was taken up as a municipal problem, and it has recently become a question of public policy. Lord Shaftesbury was influential in obtaining legislation as early as 1851. The housing problem on the Continent represents a phase of industrial life. Small homes for operatives are built near the large factories. As early as 1835 André Koechlin, a manufacturer at Mulhouse, France, began building houses for his workers. The United States has been far behind European countries. Public interest has finally been aroused by the reports of tenement-house commissions, and the knowledge of what has been done abroad. The American public was astonished to learn that New York below the Harlem was the most densely populated city in the world, with 143.2 persons to the acre in 1890, and 156.7 in 1900. The eleventh ward had in 1890 a population of 763.59 to the acre.

Efforts to improve housing conditions have been made by cities and by private individuals. The municipality has two methods: (1) Expropriation; and (2) regulation. (1) Expropriation has been carried on to some extent in all English cities. It involves questions of increased taxation resulting from the expense incurred, the displacement of the population who will overcrowd neighboring districts if not provided for, and occasionally the building of model tenements by the city. Liverpool (1866), Glasgow (1866), and London (1868) first undertook to reconstruct unsanitary districts. Later, general laws were passed, the most important of which is that of 1890, which provides for displacement and for the intervention of the municipality only when private initiative fails. Expropriation may be very expensive. The London acts of 1875-78 made unsanitary conditions a source of profit to the owners. Glasgow has been especially successful in her financial management of these areas. Edinburgh and Liverpool have left much of the expropriated ground as open space, while Dundee has converted these districts into thoroughfares. London, Liverpool, Glasgow, Huddersfield, and Birmingham have erected model dwellings. Expropriation is a success in lowering death-rates and decreasing crime. Better methods of construction make it possible to house more people in the same area. (2) Municipalities may also improve housing conditions by sanitary and building codes and provision for inspection. Such legislation includes requirements as to light, air, cellars, halls, windows, fire-escapes, plumbing, and sanitary conveniences. The New York laws are in advance of all others, for which they serve as a model, but adequate inspection is seldom provided. If owners are compelled to keep their property in a good condition, they become more careful in the choice of tenants. Thus the undesirable classes are gathered into one district where they are easily looked after. Private associations do a good work in looking up abuses until laws are well enforced and the people taught to deal directly with boards of health. In New York City there are over thirty societies. The Sanitary Aid Society, Ladies' Health Protective Association, and the New York Association for Improving the Condition of the Poor may be mentioned. The Mansion House Council on Dwellings of Poor and the Sanitary Society of Edinburgh are prominent in Great Britain. In France and Belgium the elements of household hygiene are taught in public schools.

Efforts undertaken by private individuals may be classified as: (1) Commercial, (2) semi-philanthropic, (3) philanthropic, and (4) houses built by private employers for the benefit of their employees. The commercial enterprises pay as large a per cent. as possible, giving at the same time good accommodations. The semi-philanthropic companies limit their dividends to a normal commercial rate on high-class investments. The profits of the philanthropic trusts are used in improvements and erecting new property. Housing by employers usually pays a good return. The buildings put up by these various enterprises are blocks, small houses, and lodging-houses. The very poor must rent rooms or small houses. For the lowest classes, so degraded that they cannot make use of improvements, the methods of the Octavia Hill Association are most satisfactory. Miss Hill began the work in 1864, when John Ruskin spent £3000 in purchasing unsanitary property in a vicious neighborhood. The plan is to take old property, to put in necessary repairs, to demand a prompt payment of rent, and gradually to add improvements out of the surplus from a repair fund. The standard of living of the people is raised by making the tenants realize that care on their part results in improvements. Thrift is encouraged by discounts for payment of rent in advance. When the tenants are ready, new buildings are erected. The association owns property, or, as agents, collects rents. Women volunteers have happily combined rent-collecting with friendly visiting. Similar methods have been adopted in other cities. Philadelphia has an Octavia Hill Association, Gotham

Court in New York has been improved, and Mrs. Lincoln has used this method in Boston.

Among the companies providing better housing facilities may be mentioned: In England—the Metropolitan Association for Improving the Dwellings of the Industrious Classes (1841), which owns fourteen estates in London, and pays 4½ per cent.; the Peabody Donation Fund, which owns enormous blocks of tenements; the Improved Industrial Dwellings Company of London, founded by Sir Sidney Waterloo as the result of a successful experiment (1862), which endeavors to combine beauty and utility in large blocks; the Guinness Trust. On the Continent of Europe are the Berlin Mutual Building Company (1849), and other commercial and semi-philanthropic companies in different cities. In the United States A. T. White founded the Improved Dwelling Company of Brooklyn (1876), which has erected the Home Tower and Riverside buildings, the older buildings paying 10 per cent., the new buildings 5 or 6 per cent. Other New York enterprises are the Astral Apartments (Brooklyn) of Pratt Institute; Improved Dwellings Association with model tenements at Seventy-first Street, paying 6 per cent.; Tenement House Building Company, with property on Cherry Street. In Boston, the Harrison Avenue Estate, the Rufus Ellis Memorial Building, Coöperative Building Company (1871), and the Improved Dwelling Association (1885). In Philadelphia, Theodore Starr Property. The City and Suburban Company of New York City was organized in 1896 as the outcome of the Improved Housing Conference. It aims to offer a safe investment returning 5 per cent., and to provide the best accommodations for working classes. The company is willing to undertake the reconstruction of the East Side of New York City. In this connection the Marylebone Association of London, which undertakes to improve the immediate surroundings of working-class homes, should be mentioned.

Companies have been formed to build and sell property, or to make it possible for the artisans themselves to build. The Artisans', Laborers', and General Dwelling Company of London has opened up suburban estates; the Workingmen's Dwellings Company of Passy-Auteuil, the Discount Bank of Paris, and the Berlin Building Association are important examples. In the United States, building and loan associations, started in Philadelphia, have reached low-salaried clerks and artisans. The best and cheapest method originated in Belgium in 1889, and it has been tried in France and Germany. General savings banks with Government guarantee loan capital to companies of responsible individuals, who act as intermediaries in making loans to workingmen. There are two general forms of companies: (1) Joint-stock and coöperative-loan companies, which allow the individual to select his land and lend him money to put up his house; and (2) joint-stock and coöperative-building companies, who build houses and sell them. The workman pays 10 per cent. and gives a mortgage. The important feature of this system is the arrangement for a life insurance which prevents any loss to his family in case of death.

Railroad, mining, and manufacturing companies in several countries have erected dwellings for their employees. Among the cottages and even entire villages put up by employers are those of Friedrich Krupp at Essen; Pullman Palace Car Company, Pullman, Ill.; Lever Brothers, Birkenhead, England; James Smieton & Son, Canoustie, Scotland; Van Marken Modern Dwellings, Delft; Merrimac Manufacturing Company, Lowell, Mass.; Howland Mill Corporation, New Bedford, Mass.

Another important aspect of the housing problem is the question of lodging-houses (q.v.).

Thus far the improvements in housing have hardly reached the class who need them the most. It has been satisfactorily demonstrated that commercial enterprises for building homes for the working classes pay a fair return on the investment. Of the 160,000 Londoners living in model tenements less than 25 per cent. live in tenements maintained by bequests. The tendency for rent to rise in the centre of the city makes it imperative to take away the competition of the artisan class by moving them to the suburbs. This is largely a question of rapid transit.

In the United States the twentieth century opens with a widespread interest in housing problems, largely stimulated by charity organization societies. Investigations have been set on foot in Chicago, Kansas City, Boston, New York, and Cincinnati, illustrated lectures given, and associations formed to seek to improve conditions.

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HOUS'MAN, LAURENCE (1867—). An English author and illustrator. His drawings, engraved on wood by his sister, Clemence Housman, with a flavor of the pre-Raphaelite, illustrate *The Goblin Market*, *The Were Wolf*, *Jump to Glory Jane*, and other grotesque stories and poems, as well as several of his own books, notably *The Field of Clover* (1898); *A Farm in Fairyland* (1894); and *The House of Joy* (1895). Housman wrote, besides the critical essays, *The Writings of William Blake* (1893) and *Arthur Boyd Houghton* (1896), a book of verse, *Green Arras* (1896); *All Fellows*, illustrated by the author (1896); prose allegories, with inserts of verse in the Old French manner; the clever satire, *Gods and Their Makers* (1897); a book of devotional verse, *Spikenard* (1898); and the popular *Love Letters of an Englishwoman* (1901, anonymously), which is scarcely typical of the author.

HOUSSA. See HAUSA STATES.

HOUSSAYE, o͞o'sȧ', Arsène (1815-96). A French author, born at Bruyères. He went to Paris at an early age, and at twenty-one became widely known as the author of two romances, *La couronne de bluets* and *La pécheresse.* He attracted attention particularly as an art critic, publishing his *Histoire de la peinture flamande et hollandaise* in 1846. In 1849 Houssaye was appointed director of the Comédie Française at the suggestion of Rachel, and held the place until 1856. He was a prolific writer in many departments of literature, producing poetry, dramas, romances, philosophical, historical, and critical works—the last being of especial merit. He was long editor of *L'Artiste,* and for some years was editor and proprietor of *La Presse.* Among his works are: *Histoire du quarante et unième fauteuil* (1845), dealing with the great men who failed of election to the French Academy; *La poésie dans les bois* (1845); *Le voyage à ma fenêtre* (1851); *Le roi Voltaire* (1858); *Rousseau et Mme. de Warens* (1864); and *Les confessions* (1885-91).

HOUSSAYE, Henry (1848—). A French historian and critic, born in Paris. He distinguished himself in the Franco-Prussian War, and was subsequently an editor of the *Journal des Débats* and the *Revue des Deux Mondes.* His *Histoire d'Alcibiade et de la république athénienne depuis la mort de Périclès jusqu'à l'avènement des trente tyrans* (1873) received from the French Academy the prize established by Thiers. In 1894 he was elected to the Academy. His further works include: *Athènes, Rome, Paris* (1878); *L'art français depuis dix ans* (1882). He made a careful study from the original documents of the fall of Napoleon and of the first French Empire. The work is in three parts, the first entitled *1814;* the second, entitled *1815,* includes the first Restoration, the return from Elba, and the Hundred Days. The third volume, also entitled *1815,* is devoted to Waterloo. These books are among the most readable that have ever been published upon the latter part of Napoleon's career.

HOUSTON, hū'ston. A city and the county-seat of Harris County, Tex., 50 miles northwest of Galveston; on Buffalo Bayou, an arm of Galveston Bay, at the head of navigation, and on the International and Great Northern, the Southern Pacific, the Missouri, Kansas and Texas, the Houston and Texas Central, and several other railroads (Map: Texas, G 5). It is a railroad centre of great importance, and improvements by the Federal Government have added to its transportation facilities by giving direct water communication with the Gulf of Mexico and the Atlantic Ocean; while local transit is facilitated by several bridges across the bayou. Houston occupies an area of nine square miles. It has the Houston Lyceum and Carnegie libraries, the building of the latter costing $50,000. Other prominent structures include the high school ($155,000), the United States Government building, the city hall, the court-house, the cotton exchange and market, and the Masonic Temple. The William M. Rice Polytechnical Institute, endowed with the estate of the founder, amounting to about $20,000,000, will be located in Houston. The city controls extensive commercial interests; it is one of the most important cotton markets in the United States, and in its lumber trade ranks with the leading cities of the Southwest. Cottonseed oil and sugar are also exported, and a large general trade contributes to the city's prosperity. There are extensive railroad car and machine shops, cotton-compresses and oil-mills, planing-mills, foundries and machine-shops, rolling-mills, potteries, brick and tile works, flour-mills, carriage and wagon shops, etc. The government, under a charter of 1897, is vested in a mayor, elected every two years, a municipal council, and administrative officials, who are chosen by popular vote. Houston spends annually in maintenance and operation about $565,000, the principal items of expenditure being $145,000 for interest on debt, $100,000 for schools, $70,000 for street expenditures, $55,000 for the fire department, $50,000 for the police department (including amounts for courts, jails, reformatories, etc.), and $20,000 for the health department (including amounts for charitable institutions). Houston was laid out and settled in 1836, was named in honor of General Sam Houston, and temporarily (in 1837) was capital of the Republic of Texas. Population, in 1890, 27,557; in 1900, 44,633.

HOUSTON, Sam (1793-1863). An American soldier and political leader, who was instrumental in securing the independence of Texas. He was born near Lexington, in Rockbridge County, Va., March 2, 1793, of Scotch-Irish parentage. After his father's death in 1806, the family emigrated to Tennessee, where he entered an academy, but left to try a clerkship in a store, and wearying of this, went to live among the Cherokees. He remained with them three years, when he returned to civilization and taught school. In 1813 he enlisted as a private in the United States Army; served bravely in General Jackson's campaign against the Creeks, being wounded at Tohopeka, and soon rose to be lieutenant. In 1817 he was appointed agent to aid in negotiations with the Cherokees; incurred hostility for attempting to prevent the smuggling of negroes from Florida into the United States, and resigned his commission, 1818, and began the study of law at Nashville. He soon opened an office at Lebanon, was made Adjutant-General of the State in 1819, and major of the State Militia. He was elected to Congress in 1822, was reëlected in 1824, and in 1827 was elected Governor. In January, 1829, he married Miss Allen, a Tennessee lady, but three months afterwards left her, and, resigning his office without giving either public or private reasons for his course, went to live among his old friends the Cherokees, who had emigrated to Arkansas. He championed their cause before Congress, incurring by this much enmity, especially from the 'Indian ring,' and becoming involved in an encounter with William R. Stanbury, Representative from Ohio, who had accused him of fraudulent attempts to obtain a contract for Indian rations. For beating Stanbury he was reprimanded in the House of Representatives, and was tried and fined, but President Jackson remitted the fine. The incident served to give Houston once more a national notoriety.

Visiting Texas in December, 1832, he was invited to settle there and become the leader of the American colonists in their struggle for their rights. He complied, and was elected a delegate to the convention held April 1, 1833, to form a State Constitution and seek membership in the

Mexican Republic, separate from the State of Coahuila, with which Texas had hitherto been joined and in which the anti-American party was predominant. The rejection of the Constitution and the attempt to disarm the Americans led to open warfare, and Houston was then chosen general of the military district east of Trinity River, and soon afterwards commander-in-chief of the Texan army. At the head of a small force of undrilled volunteers he led in the military movements which resulted in the defeat of Santa Anna on the San Jacinto, April 21-22, 1836, and in the independence of Texas. In September he was elected President of Texas, was inaugurated October 22d, and served again from 1841 to 1844. The annexation of Texas to the United States, in 1845, was due to his negotiations, and he was one of its representatives in the Senate from 1846 to 1859. In 1859 he was again elected Governor of Texas, but opposed secession in 1861, and refused to take an oath of allegiance to the Confederate States, for which, on March 18, 1861, he was deposed. He then retired to Huntsville, Tex., where, on July 25, 1863, he died. Consult: Williams, *Sam Houston and the War of Independence in Texas* (Boston, 1893); Crane, *Life and Select Literary Remains of Sam Houston* (Philadelphia, 1884); and Bruce, *Life of General Houston* (New York, 1891), in the "Makers of America Series." See Texas.

HOUTMAN, hout′mån, Cornelis. A famous Dutch traveler and founder of trade with the East Indies, born at Gouda in the middle of the sixteenth century. He went on a trading voyage with his brother, Frederik, to Lisbon in 1593, where he was thrown into a debtor's prison. Released by a friend, he studied the Portuguese routes to the Far East, and returning with charts to Amsterdam, organized an expedition which sailed in four ships out of the Texel (1595). He rounded the Cape of Good Hope, passed through the Straits of Sunda to the south coast of Java, and returned safely to Holland in 1597, having demonstrated an easy route to the Spice Islands. This voyage was followed by many others, and led to the formation of the Dutch East India Company. In a second expedition of two ships in a conflict with the natives of Achin, assisted by the Portuguese, he was killed.—His brother, Frederik, navigator of his fleet, also played an important part in the opening of the East to trade and commerce. In 1598 he was taken prisoner by the King of Achin, but, having been freed by Paulus van Caarden, he reached Holland in 1601, and in December, 1603, went again to the East Indies, and was Governor of Amboyna during six years. In 1609 he became commander of twenty-three ships, and in 1625 was honored with a gold medal for having opened the treasures of the East to Dutch enterprise. Almost as great as his exploits in war and commerce and explorations were his linguistic attainments. Having learned the Malay language during his captivity in Achin, he opened the Malay languages to European study. In 1603 he published a dictionary with grammatical notes of Malay and Madagascar, with comparison of many Arabic and Turkish words, which work was republished in 1680 as a grammar and dictionary of Dutch and Malay. In 1880 bronze statues of the brothers Houtman were erected at Gouda, from models by Strackée of Amsterdam.

HOUYHNHNMS, hōō-ĭn″mz *or* hōō′ĭn′mz. An imaginary nation of horses, of highly advanced civilization, gifted with reason and without passions, which Gulliver visits, in the fourth part of Swift's *Gulliver's Travels*. Their nature is supposed in the story to be as far superior to that of humanity as it is inferior in actual life.

HOVA. See Madagascar, *Ethnology*.

HOVE. A town in Sussex, England, on the English Channel, west of and adjacent to Brighton (Map: England, F 6). It has all the characteristics of its larger neighbor, handsome streets, avenues, squares, public buildings, parks and recreation-grounds, marine walk, baths, etc., and is lighted with electricity. It maintains a free library, with news-room, lending and reference departments. Population, in 1891, 28,300; in 1901, 36,500.

HOVEDON, hŭv′den *or* hōv′den, Roger of (?-c.1201). An English chronicler, born probably at Howden, in Yorkshire. He was clerk in the household of Henry II., and was employed by him on various missions. He was appointed an itinerant justice for the forests of Cumberland, Northumberland, and Yorkshire in 1189, and is supposed to have retired to Howden to write his chronicle. This begins with the year 732. Most of the work is copied, but from 1192 to 1201 is in his own writing, and has a certain value. The *Chronicle* was edited by Bishop Stubbs (1868-71, 4 vols.).

HOVELACQUE, ō′v′-låk′, Alexandre Abel (1843-96). A French linguist and anthropologist, born in Paris. He was a pupil of Chavée in languages, and of Broca in comparative anatomy. In 1876 he was one of the founders of the Ecole d'Anthropologie, in which he was made professor of linguistic ethnography, and of which, after the death of Gavarret, he became director (1890). In spite of his scientific interests, he took an active part in politics as an extreme Republican. His works include: *Mélanges des linguistique et d'anthropologie* (1889, with Emile Picot and Julien Vinson); *Les races humaines* (1882); and *Précis d'anthropologie* (1887, with G. Hervé). In 1886 Hovelacque and Chavée founded the *Revue de Linguistique*.

HO′VEN. See Bloat.

HO′VENDEN, Thomas (1810-95). An American genre painter, born in Dunmanway, Ireland. He studied at the Cork School of Art, and at the National Academy of Design after he came to America, in 1863. Afterwards he was a pupil of Cabanel in Paris. He was elected a National Academician in 1882, and was a member of the American Water-Color Society, the Society of American Artists, and the Philadelphia Society of Artists. His "John Brown Being Led to Execution" is in the Metropolitan Museum of Art, New York City. His other works include: "In the Hands of the Enemy," "Jerusalem the Golden," "Chloë and Sam," and "A Breton Interior." His composition is dramatic and effective, and his pictures are very popular.

HOVEY, hō′vĭ *or* hŭv′ĭ, Alvah (1820-1903). An American Baptist theologian. He was born at Greene, N. Y., and graduated at Dartmouth in 1844 and at the Newton Theological Institution in 1848. After a year spent in the ministry he returned to Newton Centre as a teacher, became professor of Church history (1853), of theology and Christian ethics (1855), and was president from 1868 until 1899, and afterwards was professor of apologetics. Among his works are: *The State of the Impenitent Dead* (1858); *The Scriptural Law of Divorce* (1866); *Manual of Christian Theology* (6th ed. 1900); *Systematic Theology and Christian Ethics* (1877); *Biblical Eschatology* (1888); *Studies in Ethics and Religion* (1892); and *Christian Teaching and Life* (1895).

HOVEY, hŭv′ĭ, Alvin Peterson (1821-91). An American soldier. He was born at Mount Vernon, Ind., attended the common schools, studied law, was admitted to the bar in 1843, and served successively as a circuit judge, judge of the Supreme Court, and United States District Attorney. At the outbreak of the Civil War he was appointed major of Indiana Volunteers, and later became major-general. The battle of Champion's Hill in 1863, which Grant considered the turning-point of his Vicksburg campaign, was won largely through General Hovey's efforts. When the war terminated he returned to his native State, and took an active part in politics. He became Minister to Peru in 1866, and a member of Congress in 1886, and from 1888 until his death was Governor of Indiana.

HOVEY, Charles Mason (1810-87). An American horticultural editor and nurseryman, born at Cambridge, Mass. He edited the *Magazine of Horticulture*, which prospered under his management longer than any other American horticultural journal. He was the first to introduced a pistillate strawberry, 'The Hovey,' the variety that marks the beginning of profitable strawberry culture in the United States. His *Fruits of America*, of which two volumes only were completed, is one of the best examples of art fruit-work attempted in this country.

HOVEY, Richard (1864-1900). An American poet, born at Normal, Ill. He was graduated at Dartmouth in 1885; studied for one year in the General Theological Seminary, New York; was for a time assistant in the Church of Saint Mary the Virgin, New York; and afterwards journalist, actor, dramatist, poet, and lecturer on English literature in Barnard College, New York. He passed some years in Europe, and was much influenced by French and Belgian poets, especially Maeterlinck, some of whose work he translated. His original verse was always marked by high aims, and he was ridding himself of affectations when he suddenly died. His many admirers felt that he had accomplished more than most of his poetic contemporaries, and that he died on the eve of great performances. Certainly his *Launcelot and Guenevere*—a series of dramas comprising *The Quest of Merlin*, *The Marriage of Guenevere*, and *The Birth of Galahad* (1880-98)—and *Taliesin: A Masque* (1900), though they scarcely show dramatic mastery, exhibit lyrical power and remarkable imagination. *Seaward* (1893) is an elegy upon T. W. Parsons (q.v.). Hovey also collaborated with Bliss Carman (q.v.) in *Songs from Vagabondia* (1893; another series, 1896), and published a collection of his miscellaneous poems in *Along the Trail* (1898). In these works he showed that he could touch the more immediate and ordinary human interests; but these are on the whole not emphasized in his work, which belongs to the idealistic school.

HOW, William Walsham (1823-97). An English prelate, born at Shrewsbury. He was educated at Oxford, and after holding several curateships became rector of Whittington Scropshire (1851), which position he held until he went to the Parish of Saint Andrew Undershaft, in London (1879). In that year he was appointed Suffragan Bishop of Bedford, and a year afterwards Bishop of Wakefield. His numerous works in prose include: *Private Life and Ministration of a Parish Priest* (1873); *Commentary upon Saint John* (1879); *The Papal Claims in the Light of Scriptural History* (1881); and some *Pastoral Lectures* (1883). He also wrote some *Poems* (1886) and *Hymns* (1886).

HOWADJI, hou-ăj′ĭ. A nom-de-plume of George William Curtis.

HOW′ARD. A city and the county-seat of Elk County, Kan., 72 miles south of Emporia, on the Elk River and on the Atchison, Topeka and Santa Fé Railroad (Map: Kansas, F 4). Farming and stock-raising are the leading industries. Population, in 1890, 1015; in 1900, 1207.

HOWARD. A noble English family, which for many centuries has stood at the head of the English peerage, and has held the dukedom of Norfolk since the middle of the fifteenth century. The earliest of the house to gain distinction was Sir William Howard, a learned Chief Justice of the Common Pleas under Edward I. and Edward II. His grandson, Sir John Howard, was admiral and captain of the King's navy in the north of England and also sheriff of Norfolk, in which county he held extensive estates, subsequently increased by the marriage of his grandson, Sir Robert, with the co-heiress of the House of Mowbray, Dukes of Norfolk. The only son of this union was Sir John Howard, one of the leading supporters of the House of York, who, having gained early distinction in the French wars of Henry VI., was appointed by Edward IV. constable of the important castle of Norwich, and sheriff of Norfolk and Suffolk. Afterwards he became treasurer of the royal household, obtained a grant of the whole benefit that should accrue to the King by coinage of money in the city and Tower of London, and elsewhere in England; and was raised to the peerage as Lord Howard and Duke of Norfolk. We find him in 1470 made captain-general of the King's forces at sea, and most strenuous in that capacity in his resistance to the House of Lancaster. Finally he was created Earl Marshal of England, an honorary distinction still borne by his descendants, and in 1484 was appointed Lord Admiral of England, Ireland, and Aquitaine. He fell next year, however, on Bosworth Field, and after his death his honors were attainted, as also were those of his son Thomas, who had been created Earl of Surrey. The latter, however, after suffering three years of imprisonment in the Tower of London, obtained a reversal of his own and his father's attainders, and became distinguished as a general, winning fame by his defeat of the Scotch at Flodden in 1513. His son Thomas, third Duke of Norfolk, by his marriage with a daughter of King Edward IV., became the father of the accomplished but ill-fated Earl of Surrey, who was put to death by Henry VIII. Norfolk, too, was sentenced, but the death of Henry saved him from the block. The Earl's son Thomas, fourth Duke of Norfolk, suffered attainder, and was executed on Tower Hill for high treason, for his communication with Mary, Queen of Scots. The family honors, however, were restored, partly by James I., to his grandson, and partly by Charles II., to his great-great-grandson, Thomas, who became eighth Duke, and whose cousin and successor, Charles, ninth Duke, was the direct ancestor of the present Duke of Norfolk.

In one or other of their widespread branches, the Howards either have enjoyed within the last three centuries, or still enjoy, the earldoms of Carlisle, Suffolk, Berkshire, Northampton, Arundel, Wicklow, Norwich, and Effingham, and the baronies of Bindon, Howard de Walden, Howard of Castle Rising, and Howard of Effingham.

Among the other distinguished members of the family, Sir Edward Howard, brother of the first Earl of Surrey, was made by Henry VIII. King's standard-bearer and admiral of the fleet, in which capacity he lost his life in boarding a French vessel off Brest in 1513; his brother, Sir Edmund, acted as Marshal of the Horse at Flodden, and his half-brother, Sir Thomas Howard, was attainted, and died a prisoner in the Tower, for aspiring to the hand of Lady Margaret Douglas, daughter of Margaret, Queen of Scotland, and niece of Henry VIII., one of whose ill-fated consorts was Lady Catharine Howard. Consult: Collins, *Peerage of England* (5th ed., London, 1779); Dugdale, *Baronage of England* (London, 1675-76); Doyle, *Official Baronage of England* (London, 1886); Howard, *Memorials of the Howard Family* (privately printed, 1834); Lodge, *Portraits of Illustrious Personages* (London, 1835).

HOWARD, Benjamin Chew (1791-1872). An American statesman, born at Belvedere, Md., son of John Eager Howard, Revolutionary officer, and grandson of Chief Justice Benjamin Chew. He was educated at Princeton (1809), studied law, and practiced in Baltimore. In 1814 he was active in the defense of the city, and he fought at North Point. He was a United States Representative (1829-33, 1835-39), became head of the Committee on Foreign Relations, and wrote its report on the boundary question. For twenty years he was reporter of the United States Supreme Court. He was nominated for Governor of his State in 1861, but withdrew his name. In the same year he was delegate to the Peace Congress. His *Reports of Cases in the Supreme Court of the United States from 1843 till 1855* was published in the latter year.

HOWARD, Blanche Willis (1847-98). An American novelist, born in Bangor, Maine. She was educated in New York City, but dwelt after 1878 in Stuttgart, where she taught and wrote. In 1890 she married Baron von Teuffel, a physician. The more noteworthy of her novels are: *One Summer* (1875); *Aunt Serena* (1880); *Guenn* (1882); *Aulnay Tower* (1886); *The Open Door* (1889); *No Heroes* (1893), a story for boys; *A Fellowe and His Wife*, in collaboration with William Sharp (1892); a volume of short stories, *Seven on the Highway* (1897); the posthumously published *Dionysius the Weaver's Heart's Dearest* (1899), and *Garden of Eden* (1900). She wrote also a book of travel, *One Year Abroad* (1877).

HOWARD, Bronson (1842—). A well-known American dramatist, born at Detroit. He prepared for college at New Haven, but instead of entering Yale, turned to journalism in New York. From 1867 to 1872 he worked on several newspapers, among them the *Evening Mail* and the *Tribune*. So early as 1864 he had written a dramatic piece called *Fantine*, which was played in Detroit, but his first important play was *Saratoga*, produced by Augustin Daly in 1870. It was very successful, and became the first of the long series of pieces which gave Mr. Howard a foremost position among American playwrights. Among his other best-known plays are: *The Banker's Daughter* (1878); *Old Love Letters* (1878); *Young Mrs. Winthrop* (1882); *One of Our Girls* (1885); *The Henrietta* (1887); *Shenandoah* (1889); and *Aristocracy* (1892). In 1899 he collaborated with Brander Matthews in *Peter Stuyvesant*. *Aristocracy*, which is a satire upon some features of Anglomania in American society, has been called its author's best play, though the war drama of *Shenandoah* is more ambitious, and *Old Love Letters*, in quite a different line, is an inimitable bit of sentimental comedy. Mr. Howard married a sister of Sir Charles Wyndham, the English actor, and he made his home in both New York and London, where some of his plays have been no less popular than in America.

HOWARD, Catharine (1520-42). Fifth wife of Henry VIII. She was a daughter of Edmund Howard, third son of the Duke of Norfolk. The King married her soon after the divorce of Anne of Cleves, in 1540. She was accused of immoral conduct before her marriage, and of suspicious conduct after it. After a trial, in which her guilt seems to have been established, she was beheaded with Lady Rochfort, who had connived at her intrigues, February 13, 1542. Consult Froude, *History of England*, vol. iv. (London, 1858).

HOWARD, George Elliott (1849—). An American educator and author, born at Saratoga, N. Y. He graduated at the University of Nebraska in 1876, studied at the universities of Munich and Paris in 1876-78, and was professor of history in the University of Nebraska from 1879 to 1891. From 1891 to 1901 he was the head of the history department and professor of American and institutional history at the Leland Stanford, Junior, University, and in 1902 gave special courses in history at Cornell University and the University of Wisconsin. In 1885-91 he was secretary of the Nebraska State Historical Society. His writings, in addition to contributions to professional and other magazines, include: *Local Constitutional History of the United States* (1889); *The Evolution of the University* (1890); and *The King's Peace and the Local Peace Magistracy* (1891).

HOWARD, George William Frederick. See Carlisle, seventh Earl of.

HOWARD, Henry. See Surrey, Earl of.

HOWARD, Jacob Merritt (1805-71). An American legislator, born at Shaftsbury, Vt. He graduated at Williams College in 1830, studied law, and began to practice in Detroit, Mich. He was a member of the State Legislature in 1838, and in 1840 was elected to Congress as a Whig, in which party he was an active campaign worker in 1844, 1848, and 1852. He took a prominent part in bringing about a coalition of the Whigs and Free-Soil Democrats in 1854; was the author of the platform drawn up at a State convention of the two parties held at Jackson, Mich., on

June 6, 1854, and is said to have suggested the name of 'Republican' for the new political organization thus brought into existence. He was nominated for Attorney-General of the State by the new party in that year, and was elected and reëlected twice thereafter, serving until 1859. In 1862 he was elected to the United States Senate, to fill a vacancy caused by the death of Senator Bingham, and was reëlected for a full term in 1864. He translated from the French the *Secret Memoirs of the Empress Josephine* (1847).

HOWARD, JOHN (1726-90). An English philanthropist, best known for his work in behalf of prison reform. He inherited a considerable fortune from his father, and spent his early life in travel. Settling at Cardington, Bedfordshire, in 1756, he erected model cottages for his tenants, and furnished schools for children of all sects. In 1773 he was appointed high sheriff of Bedfordshire, and soon the defective arrangements of prisons and the intolerable distress of prisoners were brought under his notice. Finding that all the abuses he had seen at home existed in neighboring counties, he traveled all over the United Kingdom, and finally became a self-appointed prison inspector, not only of Great Britain and Ireland, but of all Europe. He gave evidence before the House of Commons, and in 1774 laws were passed for the improvement of the sanitation of prisons and the abolition of jailers' fees. In 1777 he published his *State of the Prisons in England and Wales, with . . . an Account of Some Foreign Prisons.* After each of his many tours new editions, with additional facts, were published. One important result of this book was the adoption of the hard-labor system in English prisons. In 1785 Howard investigated the infection hospitals of Europe, with a view to discovering the best means of preventing the plague, and published *An Account of the Principal Lazarettos in Europe* (1789). He died of camp fever, while studying the Russian military hospitals. He was a man of deep religious feelings. He traveled more than 50,000 miles in making his investigations, on which he spent at least £30,000 of his own fortune, refusing all Government aid. Of the numerous works on Howard, consult, especially, his *Correspondence*, edited by J. Field (1855), and lives by Hepworth Dixon (1849), by J. Field (1850), and by John Stoughton (1853; new ed. 1884).

HOWARD, JOHN EAGER (1752-1827). An American soldier, born in Baltimore County, Md. He served throughout the Revolutionary War, participating in the battles of White Plains, Germantown, Monmouth, Camden, Cowpens, Guilford Court House, and Eutaw Springs, becoming lieutenant-colonel in 1780, and receiving a silver medal from Congress for his conduct at the battle of Cowpens. He was wounded at Eutaw Springs. At the close of the war he entered politics, and represented Maryland in Congress from 1787 to 1788. He was the Governor of his State from 1789 to 1792. In 1795 he was a member of the Maryland Senate; was a United States Senator from 1796 to 1803, declining in 1796 the portfolio of Secretary of War; and in 1798 was made a brigadier-general by Washington, when a war with France seemed certain. He organized a defense of Baltimore in 1814, when the English forces threatened the city, and two years later was a Federal candidate for Vice-President.

HOWARD, LELAND OSSIAN (1857—). An American entomologist, born at Rockford, Ill. He took a scientific course at Cornell, and was assistant in entomology at the United States Department of Agriculture until 1894, when he was made chief of the service. He edited the journal *Insect Life*, lectured on entomology, and wrote on that subject for the *Century* and *Standard* dictionaries. He was made permanent secretary of the American Association for the Advancement of Science; honorary curator in the United States National Museum, and wrote *Mosquitoes* (1901), *The Insect Book* (1901), and many articles in Government Reports and magazines.

HOWARD, OLIVER OTIS (1830—). An American soldier. He was born in Leeds, Maine; graduated at Bowdoin in 1850, and at West Point in 1854; served as chief of ordnance during the Seminole troubles of 1857; and was assistant professor of mathematics at West Point from 1857 to 1861. Leaving the Regular Army in June, 1861, he became colonel of the Third Maine Volunteers, and commanded a brigade in the first battle of Bull Run. He was promoted to be brigadier-general of United States volunteers in September; participated in the Peninsular campaign; and in the battle of Fair Oaks (June 1, 1862) received a wound which necessitated the amputation of his right arm. After a short leave of absence he rejoined the Army of the Potomac; took a prominent part in the battle of Antietam; was promoted to be major-general of volunteers in November; and was engaged in the battle of Fredericksburg (December 13th). In April, 1863, he was placed in command of the Eleventh Army Corps, and as such took a conspicuous part in the battles of Chancellorsville and Gettysburg. He then served in the Chattanooga campaign, taking part in the battle of Chattanooga, and accompanying Sherman on his march for the relief of Knoxville. From April to July, 1864, he commanded the Fourth Army Corps of the Army of the Cumberland, and during the march to the sea and the campaign in the Carolinas commanded the Army of the Tennessee, which constituted the right wing of General Sherman's army. In December, 1864, he was appointed brigadier-general in the Regular Army, and in March, 1865, was brevetted major-general for services at Ezra Church and during the Atlanta campaign. From May, 1865, to July, 1874, he was commissioner of the Bureau of Refugees, Freedmen, and Abandoned Lands. Within less than three years 1400 schools (not including 700 Sabbath schools) had been established, and many of the freedmen had been enabled to buy and maintain homesteads of their own. (See FREEDMEN'S BUREAU.) In 1874 Howard was placed in command of the Department of the Columbia, and in this capacity conducted the operations against the Nez Percés Indians in 1877, and against the Bannocks in 1878. He subsequently was superintendent of the United States Military Academy at West Point (1881-82), and commanded successively the departments of the Platte, of California, and of the East. In 1886 he was appointed major-general in the Regular Army, and in November, 1894, retired from the service. In 1895 he founded the Lincoln Memorial University at Cumberland Gap, Tenn. Besides numerous magazine articles, his publications include: *Donald's School Days* (1879); *Chief Joseph, or the Nez Percés in Peace and*

War (1881); *General Zachary Taylor* (1892), in the "Great Commanders Series;" *Isabella of Castile* (1894); *Fighting for Humanity;* and *Henry in the War*. Consult Stowe, *Men of Our Times* (New York, 1868).

HOWARD, Sir Robert (1626-98). An English dramatist, son of Thomas Howard, first Earl of Berkshire, by Elizabeth, daughter of William Cecil, Lord Burghley. During the Civil War he took the Royalist side, and was knighted (1644). He was imprisoned under the Commonwealth in Windsor Castle; but after the Restoration lucrative posts were given him, and he sat in Parliament. He is the Crites of Dryden's *Essay on Dramatic Poesy*. Dryden married his sister Elizabeth. Of Howard's five extant plays, *The Committee* (1692), caricaturing the manners of the Commonwealth, is most interesting.

HOWARD, Thomas, Earl of Arundel. See Arundel.

HOWARD UNIVERSITY. An educational institution, situated in Washington, D. C., incorporated in 1867, and named for Gen. O. O. Howard, one of its founders and early presidents. The university was established by the Government, and, with the exception of its medical department, is supported by Congressional appropriations administered by the Secretary of the Interior. It has, in addition, a general endowment fund of $175,000, and property valued at $1,000,000. The university is non-sectarian, and is open to students of both sexes, without regard to race. It is chiefly known, however, for its work in the higher education of the negro. No tuition is charged in any department except the medical, and the outside expenses of worthy students are also partially defrayed by the university. In addition to preparatory, collegiate, and medical departments, the university maintains schools of pedagogy, law, pharmacy, dentistry, theology, music, and agriculture. Trade instruction is provided by the industrial department, in which students of the preparatory and English courses are given practice in carpentry, tinsmithing, printing, and bookbinding, under the direction of skilled workmen. The university printing-office issues monthly the *Howard Standard*. In 1902 the students, exclusive of those in the departments of agriculture and music, numbered 939. The library contains about 40,000 volumes.

HOWARTH, hou'ĕrth, Ellen Clementine (1827-99). An American poet, born at Cooperstown, N. Y. She wrote a number of songs, such as "'Tis but a Little Faded Flower," and published a volume, *The Wind-Harp and Other Poems* (1864). Her later work has been edited, with an introduction by Richard W. Gilder.

HOWE, Albion Paris (1818-97). An American artillery officer in the War of the Rebellion. He was born in Maine and educated at West Point. He entered the Fourth Artillery, from 1843 to 1846 was a mathematical instructor at West Point, served creditably in the Mexican War, was made a captain in 1855, and after the outbreak of the rebellion became General McClellan's chief of artillery in western Virginia in 1861. During the campaign on the Peninsula, in 1862, he commanded a light-artillery brigade in the Army of the Potomac. Having been appointed a brigadier-general of volunteers in 1862, he was assigned to a brigade in Couch's division, Fourth Army Corps; was in command of the artillery depot at Washington in 1864-66; and was brevetted major-general in the Regular Army in 1865 for meritorious service during the rebellion. General Howe took part in the battles of Manassas, South Mountain, Antietam, Fredericksburg, and Gettysburg. He was retired from the army in 1882.

HOWE, Elias (1819-67). An American inventor, born in Spencer, Mass. His father was a miller, and after working in his mills the boy went, in 1835, to Lowell, where he entered a manufactory of cotton machinery. Two years later he lost his position on account of the financial panic, but finally secured work in a machine-shop, first in Cambridge, and later in Boston. About 1843 he commenced the practical working out of his idea for a sewing-machine, and by 1845 the invention was finished; but, despite its obvious advantages, met with bitter opposition. For the next nine years Howe was wretchedly poor. A trip to England in 1847 in hope of being able to interest capitalists there was unsuccessful, and he sold the English rights to his machine for $250. Upon his return to this country he found that his invention had been pirated, and that many sewing-machines were already in use. He secured influential backing, and immediately began action to establish his patent. After long suits he won his case, and thereafter was one of the leading manufacturers in the United States. Although improvements on Howe's machines were subsequently made by Singer and others, there is no doubt that the Howe was the original prototype of the present machine. When the Civil War broke out, Howe volunteered as a private in the Seventeenth Connecticut Volunteers. In 1867 he received the gold medal and the cross of the Legion of Honor at the Paris Exhibition.

HOWE, Henry (1816-93). An American historian and publisher, born at New Haven, Conn., son of Gen. Hezekiah Howe, the publisher. He entered the publishing business in 1839, and in 1840 began his historical research in New York and New Jersey, together with John W. Barber. He made like studies in Ohio, sketching old landmarks and interviewing old settlers. Soon after the publication of his work in Ohio he removed to Cincinnati, where he published subscription books for nearly thirty years. In 1878 he returned to New Haven, but in 1885 went back to Ohio, prepared a second edition of his history of that State, and entered the publishing business again. He wrote: *Eminent Mechanics* (1839); *Historical Collections of New York* (1841), of *New Jersey* (1843), and of *Ohio* (1847 and 1891); *The Great West* (1851); *Travels and Adventures of Celebrated Travelers* (1853); *Life and Death of the Ocean* (1855); *Adventures and Achievements of Americans* (1858); *Our Whole Country* (1861); *Times of the Rebellion in the West* (1876); *Over the World* (1883); *Outline History of New Haven* (1884); and *New Haven Elms and Greens* (1885).

HOWE, John (1630-1705). A Puritan clergyman, called the *Platonic Puritan*. He was born May 17, 1630, at Loughborough, in Leicestershire. He studied both at Cambridge and Oxford, and after preaching for some time at Winwick, in Lancashire, and Great Torrington, in Devonshire, he was appointed domestic chaplain to Cromwell in 1656. He held the same position under Richard Cromwell, but in 1659 returned to Torrington, where the position he had held during the Commonwealth made him an object of close suspicion to the Government. The Act of Uniformity ejected him from his parish (1662), and he wandered about preaching in secret till 1671, when he was invited by Lord Massereene, of Antrim Castle, in Ireland, to become his domestic chaplain. There he began his greatest work, *The Good Man the Living Temple of God* (1676-1702), which occupies one of the highest places in Puritan theology. In 1676 he became pastor of the dissenting congregation in Silver Street, London. In 1677 he published, at the request of Robert Boyle, *The Reconcilableness of God's Prescience of the Sins of Men with the Wisdom of His Counsels and Exhortations;* in 1681, *Thoughtfulness for the Morrow;* in 1682, *Self-Dedication;* in 1683, *Union Among Protestants;* and in 1684, *The Redeemer's Tears Wept Over Lost Souls.* In 1685 he was invited by Lord Wharton to travel with him on the Continent; and, after visiting the principal cities, in 1686 he settled, owing to the state of England, at Utrecht. In 1687 King James's "Declaration for Liberty of Conscience" induced him to return to England, and at the revolution the next year he headed the deputation of dissenting clergymen when they brought their address to the throne. Besides smaller works, he published, in 1693, *Carnality of Religious Contention;* in 1694-95, several treatises on the Trinity; in 1699, *The Redeemer's Dominion Over the Invisible World;* and he continued writing till 1705, when he published *Patience in Expectation of Future Blessedness.* He died in London, April 2, 1705. His works have been several times reprinted. For his life, consult: Rogers (London, 1879), and Horton (ib., 1896).

HOWE, Joseph (1804-73). A Canadian statesman, born at Halifax, N. S. He was the son of John Howe, a Boston printer and Loyalist, who settled at Halifax on the outbreak of the Revolution. From the printer's office the son pushed his way into journalism, becoming in 1828 proprietor and editor of the *Nova Scotian.* To this famous newspaper he contributed remarkable sketches under the titles "Western and Eastern Rambles" and "The Club," and the no less remarkable papers called "Legislative Reviews." In his journal first appeared also T. C. Haliburton's (q.v.) "Sayings and Doings of Sam Slick." Elected to the local Parliament in 1836, Howe became the most conspicuous figure in his province. Mainly through his efforts a responsible government was won for Nova Scotia. He became a member of the Executive Council (1840), Speaker of the Assembly (1840), Secretary of State for the Dominion (1870). and Governor of Nova Scotia (1873). Consult: His *Speeches and Public Letters,* edited by Annand (Boston, 1858); and Fenety. *Life and Times of Howe* (Saint John, N. B., 1896).

HOWE, Julia (Ward) (1819—). An American poet, philanthropist, and sociological writer, active in the agitation for the legal and political rights of women. She was born in New York, of wealthy parents, and married, in 1843, Dr. S. G. Howe, a philanthropist, best known for his labors for the education of the blind. With him she edited the Boston *Commonwealth,* an anti-slavery journal, lecturing also on social subjects and preaching occasionally in Unitarian pulpits. After the war she became a noted advocate of female suffrage, and of prison and other reforms. Her early publications, *Passion Flowers* (1854), *Words for the Hour* (1856), and *Later Lyrics* (1866), were in verse, the best known of her pieces being the once immensely popular "Battle Hymn of the Republic," which was written in 1861, and inspired by the sight of troops marching to the tune of "John Brown's Body." She wrote also during this period two dramas, *The World's Own* (acted in 1855), and *Hyppolytus* (1858). The more significant of her later works are: *Sex and Education* (1874); *Modern Society* (1881); a *Life of Margaret Fuller* (1883); and valuable autobiographical *Reminiscences, 1819-99* (1899). Her verse is collected in *From Sunset Ridge, Poems New and Old* (1898).

HOWE, Richard, Earl (1725-99). A British admiral. He was the second son of Emanuel Scrope, second Viscount Howe of the Irish peerage. He left school at Eton when only fourteen, and went with Anson on the *Severn* to attempt a voyage around the world. He commanded the *Baltimore,* which, with the *Greyhound* and *Terror,* fought two large French frigates off the west coast of Scotland, in 1746. The English squadron was beaten, and Howe was severely wounded. In 1755 his ship, the *Dunkirk,* captured the *Alcide* off Newfoundland. His next service was under Sir E. Hawke, in the expedition against Rochefort. Ordered to attack the fort on the Isle of Aix with his ship, the *Magnanime,* he compelled it to surrender, and achieved the only material success which attended the expedition. He was commodore of the squadron which sailed in 1758 for Saint-Malo. The troops were landed and reëmbarked without loss, after destroying all the magazines and shipping in the port. In the same year he took Cherbourg and destroyed the magazines and cannon. A second attack upon Saint-Malo was repulsed with great loss of life. In 1758, after his brother, a brigadier-general, was killed at Ticonderoga, Howe succeeded to the Irish title of viscount and to the family estate. He continued his distinguished naval service to the end of the Seven Years' War.

In 1760 he was made colonel of the Chatham division of marines, and afterwards a Lord of the Admiralty and Treasurer of the Navy. In 1776 he was placed in command of the fleet on the American coast. In 1778 he held his own against a superior naval force under D'Estaing. He was made a viscount of Great Britain in 1782. In that year he set out with a fleet to relieve Gibraltar. He succeeded in disembarking troops, ammunition, and supplies, and then offered battle to the combined fleets of France and Spain, which declined an engagement. This achievement gave Howe a brilliant reputation. He was made First Lord of the Admiralty in 1783, and received an English earldom in 1788. When the war with France broke out in 1793, he took the command of the Channel fleet, and next year gained the victory known as that of 'the glorious first of June.' The French fleet consisted of twenty-six ships of the line, and the English of twenty-five. Howe, in his flagship, the *Queen Charlotte,* engaged, off Ushant, the French admiral, who in less than an hour crowded all the sail he could carry, followed by as many of his ships as could get away. The English captured two ships of 80 guns, and four 74's; another 74 sank immediately after she was taken possession of. London was illuminated three nights in honor of the victory; the thanks of Parliament were voted to Howe, and George III. gave him a sword and made him a Knight of the Garter. His last service was in bringing back the mutinous seamen at Portsmouth to their duty in 1797. Consult: Barrow, *Life of Richard, Earl Howe* (London, 1838); Beatron, *Naval and Military Memoirs of Great Britain* (London, 1804); Chevalier, *Histoire de la marine française* (Paris, 1900); *British Magazine and Review* (June, 1783); O'Beirne, *A Candid and Impartial Narrative of the Transactions of the Fleet Under the Command of Lord Howe from the Arrival of the Toulon Squadron, etc.* (London, 1780); Poggi, *A Narrative of the Proceedings of His Majesty's Fleet from the 2d of May to the 2d of June, 1794* (London, 1796).

HOWE, Robert (1732-85). An American patriot and soldier, born in Brunswick County, North Carolina. After serving against the Indians, he was elected to the Assembly in 1765, and the same year Governor Tryon nominated him commander of Fort Johnson on the Cape Fear River. He served in the Assembly until 1775, was a member of the Provincial Congresses of 1774 and 1775, and took a prominent part in the preparations for revolt. On September 1, 1775, he was made colonel of the second North Carolina Regiment, afterwards a part of the Continental line, and aided General Woodford in driving Lord Dunmore, the British Governor, from Virginia. He was made brigadier-general of the Continental troops March 1, 1776, and was especially excepted from the general offer of amnesty issued by Sir Henry Clinton. He was made major-general October 20, 1777, and placed in command of the Department of the South. An unsuccessful expedition to Florida resulted in the abandonment of Savannah in December, 1778, and Howe was succeeded in his command by Gen. Benjamin Lincoln. He commanded the North Carolina troops at the defense of Charleston (1780), and was in command of West Point the same year. In 1781 he was tried by court-martial for the loss of Savannah on the complaint of the Georgia Assembly, but was honorably acquitted. During this year and again in 1783 he was sent by Washington to reduce mutinous regiments, and was entirely successful. He was sent to pacify the Indians of the West in 1785, and the same year was elected to the North Carolina Legislature, but died before taking his seat.

HOWE, Samuel Gridley (1801-76). An American reformer and philanthropist, born in Boston. He graduated at Brown in 1821, and took the degree of M.D. at the Harvard Medical School in 1824. Stirred by the poems of Byron, he offered his services to the Greeks in their struggle for independence. In Greece his services were not confined to the duties of a surgeon, in which capacity he had volunteered, but were of a more military nature, and his bravery, enthusiasm, and ability as a commander, as well as his humanity and nobility of character, won for him the title of 'the Lafayette of the Greek Revolution.' He continued in the service until 1827, when he returned to America to raise funds and supplies to alleviate the famine and suffering in Greece. Through his efforts more than $60,000 was raised, besides large donations of food and clothing, with which, after writing his *Historical Sketch of the Greek Revolution* (1828), he went again to Greece, where he remained until 1830, and became surgeon-in-chief of the Greek fleet. Before leaving Greece he settled a successful colony of exiles at Corinth. He then spent some time in medical studies at Paris, where his enthusiasm for a republican form of government led him to take part in the July Revolution. In the following year he returned to the United States, and became interested in the work with which his name will be longest connected—the education of the blind. He returned to Europe to study the existing systems in England and France; but his investigations were interrupted in the winter of 1831-32, when he became chairman of the 'American-Polish Committee' at Paris, organized by himself, J. Fenimore Cooper, S. F. B. Morse, and several other Americans living in the city, for the purpose of giving relief to the Polish political refugees who had crossed over the Prussian border into Prussia. Dr. Howe undertook to distribute the supplies and funds personally, and while in Berlin was secretly seized by the Prussian authorities and imprisoned for five weeks. In the latter part of the same year (1832) he returned to Boston, where he met with great success in his educational work, and the Perkins Institution for the Blind, as it was named, in honor of its principal benefactor, became the greatest school of its kind in the world. Dr. Howe himself was the originator of many improvements in method, as well as in the processes of printing books in raised types. Besides acting as superintendent of the Perkins Institution to the end of his life, he was instrumental in establishing a large number of institutions of a similar character throughout the country. At the Perkins Institution his most remarkable achievement was in the education of Laura Bridgman. The care and education of idiots and feeble-minded, the reform of prisons, abolition of imprisonment for debt, and finally the abolition of negro slavery in the United States, all engaged Howe's attention. He entered publicly into the anti-slavery struggle for the first time in 1846, when, as a 'Conscience Whig,' he was an unsuccessful candidate for Congress against Robert C. Winthrop. In 1851 he was one of the founders and editor of an anti-slavery paper, the Boston *Daily Commonwealth,* upon which his wife, Julia Ward Howe (q.v.), whom he had married in 1843, assisted him. He was one of the most prominent members of the 'Kansas Committee' in Massachusetts, and with Sanborn, Stearns, Theodore Parker, and Gerrit Smith was interested in the plans of John Brown, although he disapproved of the latter's attack upon Harper's Ferry. During the Civil War Howe was one of the directors of the Sanitary Commission, and at its close entered into the work of the Freedmen's Bureau. He was the originator of the State Board of Charities of Massachusetts, in 1863, the first board of the sort in America, and was its chairman from that time until 1874. In 1866 he made a last trip to Greece to carry relief to the Cretan refugees, and in 1870 was a member of the commission sent by President Grant to inquire into the practicability of the annexation of Santo Domingo. It is probably not too much to say that no man ever lived in America who so truly deserved the name philanthropist in its highest and best sense—a lover of his fellow-men; and no American certainly was ever connected with more great reforms that were brought to a successful conclusion. Consult Sanborn, *Dr. S. G. Howe, the Philanthropist* (New York, 1891).

HOWE, TIMOTHY OTIS (1816-83). An American lawyer and politician, born in Livermore, Maine. He was admitted to the bar in 1839, and in the following year became a Whig member in the Maine Legislature. In 1840 he was obliged by ill health to give up his career in Maine, and removed to Green Bay, Wis., which was his home during the rest of his life. In 1850 he was elected judge of the Circuit and Supreme courts of Wisconsin. From 1861 to 1879 he was a member of the United States Senate as a Republican, and served on the committees of Finance, Commerce, Pensions, and Claims. He declined an appointment to the vacancy in the United States Supreme Court occasioned by the death of Judge Chase. In 1881 he became Postmaster-General in President Arthur's Cabinet, and in the latter part of that year went to Paris as a United States delegate to the International Monetary Conference.

HOWE, Sir WILLIAM (1729-1814). A British soldier in the American Revolution, younger brother of Richard, Earl Howe (q.v.), whom he succeeded as fifth Viscount Howe in 1799. He was educated at Eton, was appointed a cornet in 1746, and saw service in Flanders. In 1750 he became captain, and in 1757, having attained the rank of lieutenant-colonel, he was placed in command of the Fifty-eighth Foot, and sent with it in the following year to America, where he took part in the siege and capture of Louisburg and accompanied Wolfe on his expedition to Quebec. After the capture of Montreal, in 1760, he returned to Europe, and in 1762 was adjutant-general of the expedition against Havana. After the close of the Seven Years' War he was made colonel of the Forty-sixth Foot (1764), was elected to Parliament as a Whig from Nottingham, and in 1768 was appointed Lieutenant-Governor of the Isle of Wight. He attained the rank of major-general in 1772. When the rupture with the American Colonies became imminent, Howe was pronounced in his condemnation of the Government's course. Nevertheless, in spite of this feeling, and of his dislike for General Gage, he commanded the reënforcements sent to the latter at Boston in March, 1775. He commanded the British in the battle of Bunker Hill, on June 17th following. Later he was made a lieutenant-general, and in October succeeded Gage in command of all the troops in America outside of Canada, with the local rank of general. He was besieged in Boston by Washington during the winter of 1775-76, and, being compelled to abandon the city, withdrew his troops to Halifax, and afterwards transferred his command to Staten Island, whence he moved on New York, winning the battle of Long Island on August 27, 1776, and occupying the city on September 15th. On October 28th he defeated Washington at White Plains, and afterwards captured Forts Washington and Lee, after which he settled down in New York for the winter. It was not until June, 1777, that he again took the field. Wishing to reach Philadelphia, and finding that he had not a sufficiently large force to advance across New Jersey in the face of Washington's army, he embarked his troops, and sailed down the coast and up the Chesapeake Bay as far as Elkton, where he landed his forces on August 28th. Marching northward, he encountered and defeated Washington at the Brandywine on September 11th, and on September 27th occupied Philadelphia. On October 4th the Americans were repulsed at Germantown. After hearing the news of Burgoyne's surrender at Saratoga on October 17th, Howe made arrangements to stay in Philadelphia during the winter, while Washington went into winter quarters at Valley Forge. Howe had sent in his resignation shortly after taking Philadelphia, but it was not accepted until May, 1778, when Sir Henry Clinton was appointed to succeed him. Before leaving Philadelphia his officers gave him a farewell entertainment in the shape of a mock tournament, which they named the 'Mischianza' (q.v.). He was severely criticised for his inactivity at Philadelphia, and in 1779, after his return to England, his conduct was the subject of a Parliamentary inquiry; but the examining committee reached no definite decision in the matter. In 1782 he became lieutenant-general of ordnance, and attained the rank of full general in the following year. During the remainder of his life he held various commands in England.

HOW'ELL. A village and the county-seat of Livingston County, Mich., 34 miles east by south of Lansing, on the Ann Arbor and the Pere Marquette railroads (Map: Michigan, K 6). It has manufactures of flour, condensed milk, sash and doors, etc. Population, in 1890, 2387; in 1900, 2518.

HOWELL, JAMES (c.1594-1666). An English author, born in Wales. He graduated B.A. from Jesus College, Oxford (1613); traveled extensively on the Continent as agent of a London glass house, and afterwards as a representative of the Government. He was imprisoned for a time during the Civil War, but after the Restoration he was appointed historiographer royal of England. Howell wrote with ease and grace many books, of which the best is *Epistolæ Ho-elianæ; Familiar Letters, Domestic and Foreign, Divided into Sundry Sections, Partly Historical, Political, and Philosophical* (vol. i. 1645; vol. ii. 1647; together with a third vol. 1653). By 1737 this book had passed through ten editions. Consult: reprint of the tenth edition by J. Jacobs (London, 1890); and for a popular edition, the "Temple Classics Series."

HOWELL, JOHN CUMMING (1819-92). An American naval officer, born in Philadelphia, Pa., and educated at Washington College, Pennsylvania. He was appointed a midshipman in the United States Navy in 1836; saw some service in the naval operations of the Mexican War; became commander in 1862, and participated in many engagements during the Civil War, with especial distinction in the battle of Hatteras Inlet and in the two attacks upon Fort Fisher. He served as fleet captain of the European station in 1869-70; was commandant of the League Island Navy-Yard at Philadelphia in 1871-72, and of the Portsmouth Navy-Yard from 1872 to 1874. From 1874 to 1879 he was chief of the Bureau of Yards and Docks, at times acting as Secretary of the Navy; was in command of the European squadron from 1879 to 1881, and on

November 24, 1881, was retired with the rank of rear-admiral.

HOWELL, WILLIAM HENRY (1860—). An American physiologist. He was born in Baltimore and graduated in 1881 at Johns Hopkins, where he became associate professor of physiology (1888), and in 1893, after teaching in the University of Michigan and for one year at Harvard, was promoted to a professorship. He was made dean of the Medical School in 1899. Dr. Howell contributed to the London *Journal of Physiology*, the *Transactions of the Royal Society*, the *Johns Hopkins Biological Studies*, the *Journal of Morphology*, and the *Journal of Experimental Medicine*. In 1896 he edited *An American Text-Book of Physiology*. He contributed articles on physiology to the *New International Encyclopædia*.

HOW'ELLS, WILLIAM DEAN (1837—). An American novelist, editor, poet, and critic, born at Martin's Ferry, Ohio, March 1, 1837, of well-to-do Welsh-Quaker ancestry. Howells spent his youth among books. He began making verses almost as soon as he could read, serving a literary apprenticeship in his father's printing-office, afterwards as compositor on the *Ohio State Journal* and other newspapers, and still later as correspondent and editor. He first attracted marked attention by poems published in the *Atlantic Monthly*. In 1860 he published *Poems of Two Friends* with John J. Piatt (q.v.), and in the same year wrote a campaign *Life of Lincoln*, in recognition of which he received the Venetian consulate (1861-65), as a fruit of which we have *Venetian Life* (1866), a work of vivid realism, flexible style, and genuine charm, which was followed by *Italian Journeys* (1867). On his return to America Howells was connected editorially with the *Tribune*, the *Times*, and the *Nation* of New York, and, from 1866 to 1881, the *Atlantic Monthly* of Boston, of which he was the editor from 1871. *Their Wedding Journey* (1871), his first attempt at fiction, was followed, during his Boston residence, by *A Chance Acquaintance* (1872); *A Foregone Conclusion* (1874); *Out of the Question* (1876); *A Counterfeit Presentment* (1877); *The Lady of the Aroostook* (1878); and *The Undiscovered Country* (1880). *A Fearful Responsibility* (1882); *Dr. Breen's Practice* (1883); *A Modern Instance* (1883); *A Woman's Reason* (1884); *Three Villages* (1885); and *The Rise of Silas Lapham* (1885) were written during a residence in England and Italy. On his return in 1886 Howells assumed an editorial function for *Harper's Magazine*, developing strong critical powers, and steadily opposing the romantic or pseudo-historic in modern fiction, though he is himself given to fanciful thoughts. He was also for a short time editor of the *Cosmopolitan Magazine*. The more noteworthy volumes of fiction in this period are: *The Minister's Charge* (1886); *Indian Summer* (1886); *April Hopes* (1888); *Annie Kilburn* (1888); *A Hazard of New Fortunes* (1889); *The World of Chance* (1893); *The Coast of Bohemia* (1893); *The Story of a Play* (1899); *Ragged Lady* (1899); *Their Silver Wedding Journey* (1899); *A Pair of Patient Lovers* (short stories, 1901); *Heroines of Fiction* (1901); *The Flight of Pony Baker* (1902); and *The Kentons* (1902). Howells has written also many farces, of which *The Sleeping-Car, The Mouse-Trap, The Elevator,* and *Out of the Question*, are characteristic. Noteworthy also are *Tuscan Cities* (1885); *Modern Italian Poets* (1887); *Criticism and Fiction* (essays); *A Boy's Town* (1890); *A Traveler from Altruria* (1894); *Impressions and Experiences* (1896); and *Literary Friends and Acquaintance* (1900).

His poems were collected in 1873 and 1886, and a volume under the title *Stops of Various Quills* appeared in 1895. Perhaps of all the books named above, *The Rise of Silas Lapham* and *A Hazard of New Fortunes* represent their author at his best. He is the founder of the school of American realists who derive through the Russians from Balzac, and has little sympathy with any other form of fiction, although full of encouragement for new writers in whom he discovers a fresh note. His style is admirable, and his knowledge of the details of life accurate and minute. Like all innovators, he has probably had in full measure the defects of his qualities, and has in consequence alienated many readers; but it can hardly be doubted that his has been the most influential work done in American fiction during the last quarter of a century.

HOWELL'S STATE TRIALS. See STATE TRIALS.

HOW'ISON, GEORGE HOLMES (1834—). An American scholar, born in Montgomery County, Md. He graduated at Marietta College in 1852 and at the Lane Theological Seminary in 1855. After holding positions at Harvard and other universities, he was appointed Mills professor of philosophy at the University of California in 1884. His publications include: *Treatise on Analytic Geometry* (1869); and *The Conception of God* (1897).

HOW'ITT, WILLIAM (1792-1879) and MARY (1799-1888). Two English authors, who may well be treated together. William Howitt was born at Heanor, Derbyshire. His parents were Quakers. Though he attended several schools, he educated himself mostly by reading. From his youth he was fond of outdoor sports, and he celebrated in verse the scenery with which he was familiar. In 1821 he married Mary Botham, daughter of a prosperous Quaker of Uttoxeter, Staffordshire. After living for a year in Staffordshire, they settled in Nottingham, where William set up as a druggist. Here they remained for twelve years. They subsequently lived at Esher in Surrey, London, Heidelberg, and Rome. William spent two years in Australia (1852-54). Somewhat after middle life they became spiritualists. Both died in Rome and were buried there. Soon after their marriage they began to write in collaboration, and then independently. Among their joint works are contributions in verse and prose to annuals and periodicals; *The Forest Minstrel* (1823); *The Desolation of Eyam, and Other Poems* (1827); *Literature and Romances of Northern Europe* (1852); and *Ruined Abbeys and Castles of Great Britain* (1862). Among William's independent works are: *Book of Seasons, or Calendar of Nature* (1831); *Popular History of Priestcraft* (1833); *Pantika, or Traditions of the Most Ancient Times* (1835); *Rural Life of England* (1838); *Visits to Remarkable Places* (1st series, 1839; 2d series, 1841); *Boys' Country Book* (1839); *Rural and Domestic Life of Germany* (1842); *Popular History of England*

(1856-62); and *The Mad War Planet, and Other Poems* (1871). Among Mary's independent publications, numbering 110 distinct works, are translations from Fredrika Bremer and Hans Andersen; *Sketches of Natural History* (1834); *Popular History of the United States* (1859); a novel called *The Cost of Caergwyn* (1864); *Tales in Prose for Young People* (1864); *Tales in Verse for Young People* (1865); and *Tales for All Seasons* (1881). From these lists it may be seen that the Howitts did much for their generation by diffusing knowledge. On the other hand, they wrote little or nothing of permanent value. Consult *Mary Howitt: An Autobiography*, edited by her daughter, Margaret Howitt (London, 1889).

HOWITZER (from *howitz*, from Ger. *Haubitze*, formerly *Haubnitze*, from Boh. *haufnice*, *haufenice*, howitzer, sling for casting stones). A type of artillery. Although a short cannon, it differs from the mortar (q.v.), in that the latter is used for vertical fire, while the howitzer discharges its shells in a horizontal direction. It is one of the oldest forms of artillery, and was used in Europe as early as the fifteenth century, and in America it was the first type of cannon to be manufactured. It is now one of the most important types of modern ordnance, howitzer batteries forming a part of the artillery corps of all the great nations of the world. The special value of the howitzer is in indirect fire when high trajectories are neccessary, and when nothing but a large angle of descent of the projectile can be effective in attack. It has been found in recent military operations that the howitzer is of supreme importance in supplementing the gun in field and mountain artillery batteries, owing to the fact that the field gun with its flat trajectory fire prevents the enemy from exposing himself, and if the latter is strongly intrenched, he can hold his position until attacked by infantry. The curved fire of the howitzer, on the other hand, will clear the enemy's trenches, and compel resistance or a change of position. Many European authorities now advocate the addition of a howitzer gun to every battery of field and mountain artillery. In the frontier defense of Austria, the howitzer plays an important part. The pieces are of 24 centimeters (almost 10 inches) calibre, and fire a shell weighing 300 pounds, containing a heavy bursting charge of high explosive. Although not originally designed for field work, they can be moved and brought into position and fired in twenty minutes' time after arrival at the desired point. See ARTILLERY; ORDNANCE.

HOW′LAND, ALFRED CORNELIUS (1838—). An American painter, born at Walpole, N. H. He studied under Schultz and Eppindale in Boston, and afterwards went to Düsseldorf and later to Paris, where he became a pupil of Lambinet. His works in genre and landscape are: "Sunlit Path" (1871); "Ford's Glen" (1878); "Monday Morning" (1879); "The Gossips" (1880); "Rendezvous of the Veterans" (1884); and "The Coming Circus" (1886).

HOWLER, or STENTOR. An American monkey of the genus Mycetes, remarkable for the dilatation of the hyoid bone into a hollow drum, which communicates with the larynx, makes a conspicuous external swelling of the throat, and gives prodigious power to the voice, enabling these animals to emit hideous sounds, which are heard miles away, and to which all their names refer. There are two, and sometimes four, other resonators connected with the larynx, besides the one in the hyoid. The howlers live chiefly among the branches of trees, and make extraordinary leaps from one to another, taking hold by the tail as readily as by the hands, and often swinging by it alone. They are the largest monkeys in the New World. About seven species are known, occurring from Central America southward to the Rio Grande do Sul. They are sometimes kept in captivity, but are always sullen and untamed. Their habits and brain-structure both show that their position is properly among the lowest monkeys. The best known forms are those of southern Brazil, such as the very black shaggy howler, or 'guereba' (*Mycetes caraya*), of which the females and young are dingy white, and the brown 'araguata' or ursine howler (*Mycetes ursinus*). The red howler (*Mycetes seniculus*) belongs to the Orinoco region, and is distinguished by its bright chestnut color and the ridge of upright red hair across the top of its head. This one is said to furnish the principal animal food used by the natives of the eastern slopes of the Andes, but they are obtained only in the lowlands. Still another species, abundant along the lower Amazon, is the yellowish 'arabata' (*Mycetes belzebul*). See MONKEY; and Plate of AMERICAN MONKEYS.

HO-WO, hō′wō′. See FUNG-HWANG.

HOWORTH, hou′ẽrth, Sir HENRY HOYLE (1842—). An English scientific writer and politician, member of the Royal Society. He was born at Lisbon, was educated at Rossall School, and was admitted to the bar, though he practiced law very little, but devoted himself to Lancashire politics and to literature. He was elected to the House of Commons as a Conservative in 1886. He is member of many geographical and anthropological societies, and in 1899 was made a trustee of the British Museum. Howorth's writings, besides letters to the *Times* and contributions to the *Quarterly* and the *Edinburgh*, are on geological, archæological, ethnological, and historical subjects. Among these are: *History of the Mongols* (1876-78); *The Vicars of Rochdale* (1883); and *The Mammoth and the Flood* (1887).

HOWRAH, hou′rä. A town of Bengal, India, on the right bank of the Hugli, opposite Calcutta (q.v.), of which it is the most important suburb (Map: India, E 7). Population, in 1891, 116,600; in 1901, 157,900.

HOW′SON, JOHN SAUL (1816-85). An English clergyman and author. He graduated at Trinity, Cambridge, in 1837; was classical master and later principal of the Liverpool Collegiate Institution (1845-65), and from 1867 until his death was Dean of Chester. During the latter period he practically restored the cathedral, raising nearly £100,000 for the purpose. He is best known for his *Life and Epistles of Saint Paul* (1852), written in conjunction with Rev. W. J. Conybeare. He also published: *The Character of Saint Paul* (1862); *The Metaphors of Saint Paul* (1868); and other religious works, including commentaries.

HOWTH. A picturesque peninsula, forming the north shore of Dublin Bay, Ireland. It is about two and one-half miles long by two miles broad, and terminates in a cliff 563 feet high, at the foot of which is Howth village, an important fishing station.

HOY. One of the Orkney Islands (q.v.), in latitude 58° 50′ N., longitude 3° 20′ W., two miles southwest of Mainland (Map: Scotland, F 2). It is 14 miles long and 6 miles broad, and rises abruptly from the sea, with precipitous cliffs 1000 feet in height fronting the west. Ward Hill, 1555 feet high, commands a fine panoramic view of the islands. Population, in 1891, 1320.

HOY (Flem. *hui*, Dutch *heu*, *heude*, of uncertain etymology). A small vessel, usually sloop-rigged, formerly used in large harbors and rivers and to some extent as a coaster. The term is now obsolete except as applied to *powder-hoys*, *anchor-hoys*, and similar heavy-built barges (sailing or steam) used for carrying ammunition, anchors, or other heavy weights.

HOYDEN, Miss. The lively, romping daughter of Sir Tunbelly Clumsy, in Vanbrugh's comedy *The Relapse.* The rôle, a great favorite, has been played by Mrs. Clive, Mrs. Jordan, and Miss Nellie Farren. In Sheridan's *Trip to Scarborough,* she is married to Tom Fashion, who passes himself off as Lord Toppington. Robert Buchanan adapted *The Relapse,* rechristening it, after the personality of this character, *Miss Tomboy* (1890).

HOY'LAND NETHER. A manufacturing town in the West Riding of Yorkshire, England, three and one-half miles south-southeast of Barnsley (Map: England, E 3). Population, in 1891, 11,000; in 1901, 12,500.

HOYLE, Edmond (1672-1769). An English writer on games. Of his early life nothing is definitely known, although it is asserted that he was educated for the law. For many years he lived in London, writing upon, and giving instruction in, games; and in 1742 he published the *Short Treatise on Whist,* which reached a thirteenth edition in 1763, and became the world's authority. See Whist.

HOYT, Albert Harrison (1826—). An American editor and author, born in Sandwich, N. H. After completing his law studies in Portsmouth, N. H., he began to practice there, and held various civil offices. He was a paymaster of the army during the Civil War, rose to be lieutenant-colonel, and after the peace was editor of the *New England Historical and Genealogical Register* (1868-76), and of *Memorial Biographies,* vol. iv. (1885). His other works include: *Necrology of the New England Colleges* (1869-70); *Captain Francis Goelet's Visit to Boston, etc., in 1745-50* (1870); *Letters of Sir William Pepperrell, Bart.* (1874); and *The Name Columbia* (1886).

HOYT, Charles Hale (1860-1900). An American dramatist, born in Concord, N. H. He studied law, was connected for a time with the Saint Albans (Vt.) *Advertiser,* became musical and dramatic critic of the Boston *Post,* turned playwright, and wrote a series of farcical comedies, which netted the author a fortune, and contain some character-studies of more or less cleverness. The greatest success of these was called *A Trip to Chinatown* (1890). *A Midnight Bell* (1887) was his one serious attempt. He was twice a member of the New Hampshire Legislature.

HOYT, John Wesley (1831—). An American educator and administrator, born near Worthington, Ohio. He graduated at Ohio Wesleyan University (1849), and studied law and medicine. In 1857 he removed to Madison, Wis., and there edited and published the *Wisconsin Farmer.* In 1862 Hoyt was appointed State Commissioner to the London Exposition, and he was United States Commissioner at the Paris Exposition of 1867. To the Vienna Exposition of 1873 he was sent as executive commissioner, and was president of the international jury for education and science. In 1873-74, as chairman of the Wisconsin State Board of Railway Commissioners, he was instrumental in settling the Granger War. He was special representative for foreign affairs at the Columbian Exposition of 1893. Hoyt reorganized the University of Wisconsin; suggested and framed a bill for the establishment of a national university, and was appointed chairman of a committee of four hundred thereon, and from 1878 to 1883 was Governor of the Territory of Wyoming. He was president of Wyoming University from 1887 to 1891. In 1897, acting as a commissioner of the king of Korea, he procured the admission of that country to the Universal Postal Union. His publications include: *University Progress* (1869); *Of Appointment and Removal* (1885); and *History of University Education* (1903).

HRABANUS MAURUS, rȧ-bä'nōōs mou'rōōs. See Rabanus Maurus.

HRDLICKA, dlĭch'kȧ, Ales (1869—). An American anthropologist, born at Humpoletz, in Bohemia. After he had finished his secondary and academic studies he went to New York City, where he studied at the Eclectic College and the Homœopathic College. Hrdlicka made special studies of the insane; accompanied anthropological expeditions to Mexico and the Southwestern States (1898-1900), and in 1899 became director of the anthropological section of the Hyde Expedition. He became connected with the American Museum of Natural History in New York, and wrote: *Report on Anthropological Work in the State Institution for Feeble-Minded Children, Syracuse, N. Y.* (1898); *Anthropological Investigation on One Thousand White and Colored Children* (1899); besides contributions to periodicals.

HRODBERT, rôd'bĕrt, Saint. See **Rupert,** Saint.

HROLF, or **ROLF,** rŏlf, The Ganger. The conqueror of Normandy. See Rollo.

HROSWITHA, hrŏs'vē-tȧ. See Roswitha.

HUACA, hwä'kȧ, or **GUACA.** See Peruvian Antiquities.

HUAINA CAPAC, wä-ē'nȧ kä'pȧk. A Peruvian Inca. See Huayna Capac.

HUALAPAI, wä'lȧ-pī. An Indian tribe in Arizona. See Walapi.

HUALLAGA, wȧ-lyä'gȧ. See Amazon.

HUAMBISA, wäm-bē'sȧ. A savage tribe of the Jivaroan linguistic stock dwelling about the junction of the Santiago and Marañon-Amazon rivers, at the head of Amazon navigation, on the Peru-Ecuador boundary. They joined the Jivaró (q.v.) group in their revolt against the Spanish authority in 1599, and took part in the sack of Sevilla del Oro, when seven thousand Spanish women were carried off by the victors.

Evidence of this admixture remains to-day, the Huambisa as well as the Jivaro and several other tribes of the region being fair-skinned and bearded. They are implacably hostile, both to the whites and to the neighboring Indians, whom they are gradually driving from the region.

HUANACO, hwȧ-nä'kō. See GUANACO.

HUANCAVELICA, wän'kȧ-vȧ-lĕ'kȧ. A department of Peru, bounded by the departments of Lima and Junín on the north, Ayacucho on the east, Ica on the south, and Lima on the west (Map: Peru, B 6). Area, 9251 square miles. It belongs entirely to the region of the Cordilleras, and contains only a very small portion of land fit for agriculture. The mountains are rich in minerals, but little mining is carried on, since the roads are so poor that transportation is rendered extremely difficult. Population, in 1896, 223,796. The capital, Huancavelica, is situated in the northern part of the department at an altitude of over 12,000 feet, and has a population of about 3000.

HUANCAYO, wän-kī'ō. A town in the Peruvian Department of Junín, situated on the river Mantaro, at an altitude of over 10,000 feet (Map: Peru, C 6). The Constitution promulgated here in 1839 remained in force till 1860. Population, about 5000.

HUÁNUCO, wä'nụ-kō. A department of Peru, bounded by the Department of Loreto on the north and east, Junín on the south, and Ancachs on the west. Area, 14,024 square miles (Map: Peru, B 5). It is exceedingly mountainous in the western part, with a general easterly slope toward the Ucayali River. It is watered by several streams, including the headwaters of the Amazon, and is covered to a large extent with thick forests. The climate is hot and moist in the east, and cold in the mountainous regions of the west. The mountains are supposed to contain rich deposits of gold, silver, and quicksilver, but the lack of good roads prevents their exploitation. The population was estimated, in 1896, at 145,309. Capital, Huánuco (q.v.).

HUÁNUCO. The capital of the Peruvian department of the same name, situated at an altitude of nearly 6000 feet, near the river Huallaga, 170 miles northeast of Lima (Map: Peru, B 5). It is the seat of a bishopric, and was, until 1855, the capital of the Department of Junín. It was founded about 1543. About 35 miles west lies Huánuco Viejo, an Inca town settled by the Spaniards in 1535, and now almost abandoned. Population of Huánuco, about 7500.

HUARAZ, or **HUARAS**, wä'räs. Capital of the Peruvian Department of Ancachs, situated on the Huaraz River, and connected by rail with the coast (Map: Peru, B 5). It has a cool and uniform climate; its streets are narrow and its houses plain; and the only noteworthy buildings are the Government building, a hospital, a school, and two churches. Set in the wall of its cemetery is a very interesting collection of stones sculptured by the ancient Peruvians, and collected from the surrounding country. Population, about 17,000.

HUARTE, wär'tȧ, JUAN DE DIOS (c. 1520-c. 1600). A Spanish physician and philosopher, born in Navarre. He wrote a curious book on phrenology, *Exámen de ingenios para las sciencias* (1578), which was extremely popular, and was translated into several European languages—into English as *A Trial of Wits*. Some of his theories on education are very enlightened for the time, while others are fantastic in the extreme.

HUASCAR, wäs'kär (c. 1495-1533). A Peruvian Inca, born in Cuzco. He was the legitimate heir of Huayna Capac, but his father allowed him to inherit only half the kingdom, leaving the other half to a younger brother, Atahualpa, of a more fierce and warlike character, who coveted the whole. A battle between the rival claimants took place near Mount Chimborazo (1532), and Huascar was defeated, falling afterwards into the hands of his half-brother, who compelled him to look on while the women of the royal household were tortured to death. The landing of the Spaniards was the beginning of the end for Atahualpa, whose dread that they might reinstate his brother caused him to have Huascar secretly drowned in the river of Andamarca.

HUASTECS, wäs'tĕks. A detached tribe of Mayan stock (q.v.), on the shores of the Gulf of Mexico along the Pánuco in the States of Vera Cruz and San Luis Potosí. The language contains more archaic forms than any other of the stock, bearing out the traditional and other evidences that the Huastecs were left behind in the southward migration of the Maya people.

HUAYNA CAPAC, wä-ĕ'nȧ kä'pȧk (?-1523). A Peruvian Inca, born in Cuzco. His reign began in 1483, and, being by that time an experienced soldier, he waged war against his neighbors till he had conquered the country as far north as Quito, including Puná Island, Ecuador, and as far south as Atacama, Chile. A ferocious warrior, he cultivated also the peaceful art of roadmaking (notably the highway between Tumbez, Pachacamac, and Cuzco), while it was the magnificence of the palaces he had built which so impressed the first Spanish invaders. Huayna Capac had a harem of more than 600 members, and he decreed that his legitimate heir should share the huge kingdom with a younger brother, which led to the internal dissensions that made it fall an easy prey to Francisco Pizarro.

HU'BALDUS. See HUCBALD.

HUBAY, hōō'bŏ-ĭ, JENÖ (1858—). An Hungarian violinist, born at Budapest. He studied the violin with Joachim in Berlin, and in 1876 began to give concerts in Hungary, and later in Paris. He was chief violin professor at the Brussels Conservatory (1882), and at the Budapest Conservatory (1886), succeeding his father, Charles Hubay, who was also a well-known violinist. As a composer he ranks high, his operas *Der Geigenmacher von Cremona* (1893), *Alienor* (1892), and the Hungarian *A falu rózsa* (1896) being especially noteworthy.

HUBBARD, ELBERT (1859—). An American writer, and maker of fine books, born in Bloomington, Ill. He made himself widely known as the originator and proprietor of the Roycroft Shop, in East Aurora, N. Y., founded for the avowed purpose of reviving the old handicrafts, particularly that of artistic book-making. He also originated the *Philistine*, a periodical characterized by a curious jumble of shrewd but generally kindly philosophy which is sometimes marred by vulgarity and personal vilification. His other literary work includes a series of biographical sketches published under the caption, *Little Journeys*; several pamphlets, such as *A*

Message to Garcia (1898), an arraignment of the careless employee, and *Time and Chance* (1901), a graphic sketch of John Brown's career.

HUBBARD, Gardiner Greene (1822-97). An American lawyer, born in Boston. After graduating at Dartmouth (1841) and completing the law course at Harvard, he began the practice of his profession in Boston, where he lived until 1873, when he removed to Washington, D. C. Here he was intimately connected with the organization and development of the American Bell Telephone Company. He was the founder, and for many years the president, of the National Geographic Society, and was a trustee of several important educational institutions. Hubbard devoted much attention to the advancement of oral instruction among deaf mutes. He made a large collection of etchings and engravings, which were given by his widow to the Library of Congress with a fund for additions.

HUBBARD, Joseph Stillman (1823-63). An American astronomer, born in New Haven, Conn. He graduated at Yale College in 1843, and the next year went to Philadelphia, where he acted as assistant to Sears Cook Walker, who had built the observatory of the Philadelphia High School. Soon afterward he accepted a position offered him by General Frémont, then a lieutenant, as computor of the observations for latitude and longitude made during the explorer's journey across the continent. On May 7, 1845, he was appointed to a vacancy in the corps of professors of mathematics in the Navy, and was assigned to the Washington Observatory, where he remained during the rest of his life. He contributed frequently to the *Astronomical Journal* and twice, for long priods, was its editor. During his connection with the Washington Observatory he made a number of cometary investigations and important computations. He was a member of the National Academy of Sciences and of various other scientific societies.

HUBBARD, Lucius Frederick (1836—). An American soldier. He was born in Troy, N. Y., went to school in Granville, N. Y., learned the trade of a tinsmith, and followed it for three years in Chicago. In 1857 he started a newspaper in Red Wing, Minn., and afterwards served in the Civil War, conducting himself gallantly and becoming brigadier-general. Later he engaged in railroad building and milling. He was a State Senator (1872-76), Governor of Minnesota (1882-87), and in the Spanish-American War commanded a volunteer brigade.

HUBBARD, Oliver Payson (1809-1900). An American chemist, born at Pomfret, Conn. He was educated at Hamilton College, where he studied in 1825-26, and at Yale, where he graduated in 1828. He was assistant at Yale to Benjamin Silliman. From 1836 to 1866 he occupied the chair of chemistry, pharmacy, mineralogy, and geology at Dartmouth College. From 1866 to 1871 he was a general lecturer on those subjects, and from 1871 until his retirement as professor emeritus in 1883 was again connected with the faculty of Dartmouth, holding the professorship of chemistry and pharmacy. In 1832 he made investigations in the Eastern United States in connection with the examination conducted by Silliman for the Secretary of the Treasury in regard to the cultivation of the sugar-cane. He was a member of the New Hampshire State Legislature in 1863-64, and a secretary of the American Association of Geologists and Naturalists in 1844. He published a *Lecture Introductory to the Eighty-third Course of the New Hampshire Medical Institute at Dartmouth College* (1879) and a *History of Dartmouth Medical College* (1880), and contributed to the *American Journal of Science:* "Observations Made During an Excursion to the White Mountains" (1838), "Geological Surveys of New York, Ohio, Indiana, and Michigan" (1840-41), "Condition of Trap Dikes in New Hampshire" (1850), and other articles.

HUBBARD, Richard William (1817—). An American painter, born at Middletown, Conn. He studied under Daniel Huntington, and in France. His landscapes include: "Meadows Near Utica" (1869); "Vermont Hills" (1874); "Autumn, Lake George"; "Connecticut Pastoral" (1880); "Lake in the Adirondacks" (1883); and "Down in the Meadows" (1885).

HUBBARD, William (1621-1704). An American clergyman and historian, born in England. As a child he was brought by his parents to New England, graduated at Harvard (1642), was ordained, and became assistant and afterwards pastor of the Congregational church at Ipswich, Mass., a post which he resigned but a year before his death. He wrote, at the order of the Colonial Government, which paid him fifty pounds for it, a *History of New England,* mainly compilation, which barely escaped destruction by fire when Gov. Thomas Hutchinson's house was mobbed in 1765. The Massachusetts Historical Society printed it in 1815. He wrote also *A Narrative of Troubles with the Indians* (1677), which was for years popular in New England, and was even reprinted at the beginning of the nineteenth century at Worcester, Mass., 1801, and Roxbury, Mass., 1805. It is full of errors, but illustrates what was regarded by the writer's contemporaries as an elegant prose style. Minor works are a volume of sermons (1684) and *Testimony of the Order of the Gospel in Churches* (1701).

HUB′BARDTON. A town in Rutland County, Vt., 18 miles northwest of Rutland (Map: Vermont, B 7). It was the scene of a sharp conflict on July 7, 1777, between the rear-guard of General Saint Clair's army, retreating from Ticonderoga, and a British and Hessian force under Generals Fraser and Riedesel. The Americans under Colonels Warner and Francis were defeated, with a total loss in killed, wounded, and prisoners of 324 men, nearly one-third their number, while the British loss was only 183. A monument commemorates the battle. Population, in 1890, 506; in 1900, 488.

HUBE, hōō′be, Romuald (1803-90). A Polish jurist, born at Warsaw, and educated there, at Cracow, and in Berlin. From 1826 to 1832 he was professor of criminal law at Warsaw, then became head of a committee on revision of the laws of Poland, and was for a time professor at Saint Petersburg. In 1846, and again in 1867, he went with Count Bludoff on diplomatic missions to Rome. He died at Warsaw after thirteen years' service in the Russian Council of State. His works include: treatises on penal law (1828); on Polish criminalists (1830); ***Antiquissimæ Constitutiones Synodales Provinciæ Gnesnensis*** (1856); ***Loi Salique*** (1867); ***Histoire de la formation de la loi Bourguignonne*** (1867); ***Droit romain et gréco-byzantin chez les peuples***

slaves (1880); and on Polish law in the thirteenth (1874) and fourteenth (1881) centuries.

HUBER, ụ'bâr', François (1750-1831). A Swiss naturalist. He was born in Geneva, inherited a love of nature, as well as keen powers of observation from his father, studied physics under Saussure and chemistry with a relative. At fifteen he began to lose his sight. Before he became totally blind he married a Mlle. Lullin. Her devotion, his father's wealth, and the keen eyes of his man servant, Burnens, made it possible for him to carry out his pioneer researches of the life and habits of bees. In 1792 he published at Geneva, under the title *Nouvelles observations sur les abeilles,* letters to Bonnet. In later works, especially on the origin of wax and the construction of cells, Huber was assisted by his son. Among his more important discoveries were the aërial impregnation of the queen bee (see Bees); the killing of the males by the workers; the rivalry of the queens; the use of the antennæ; the origin of the propolis; and the ventilation of the hives which supplies fresh oxygen.

HUBER, hōō'bẽr, Hans (1852—). A Swiss dramatic composer, born at Schönewerd, near Olten. He studied at the Leipzig Conservatory, and became well known as a music-teacher, being appointed in 1896 director of the music school at Basel. His operas *Weltfrühling* (1894) and *Gudrun* (1896) were successfully produced at Basel, and his instrumental pieces are universally popular. Of especial excellence are his violin and piano concertos.

HUBER, Johannes (1830-79). A German theologian and philosopher, leader of the Old Catholics. He was born in Munich; was educated there, and became professor of philosophy in the university in 1859, and a fearless opponent of the Ultramontanes. His work *Die Philosophie der Kirchenväter* (1859) was put on the Index Expurgatorius. He actively opposed the dogma of infallibility, and played a conspicuous part at the first general congress of the Old Catholics at Munich, in September, 1871. With Döllinger he wrote the famous *Der Papst und das Konzil von Janus* (1869). Among his other works are: *Johannes Scotus Erigena* (1861); *Die Freiheiten der französischen Kirche* (1870); *Das Papsttum und der Staat* (1870); *Der Jesuitenorden* (1873); and *Der Pessimismus* (1876). Consult Zirngiebl, *Johannes Huber* (Gotha, 1881).

HUBER, Victor Aimé (1800-69). A German critic and social reformer, born at Stuttgart. He studied medicine and modern languages at Würzburg and Göttingen; taught at Bremen, was appointed professor of the history of literature and of modern history at Rostock in 1833, of the languages of Western Europe at Marburg in 1836, and in 1843 at Berlin. From 1851 to 1869 he lived in retirement in the Harz Mountains. His writings on Spanish, French, and English literature include: *Die Geschichte des Cid* (1829); *Crónica del Cid* (1844); *De Primitiva Cantilenarum Popularium Epicarum (vulgo Romances) apud Hispanos Forma* (1844); *Skizzen aus Spanien* (1828 sq.); *Die neuromantische Poesie in Frankreich* (1833); and *Die englischen Universitäten* (1839-40). He was for a time a Conservative in politics, and founded the journal *Janus;* but later became a Socialist. Consult: Elvers, *Victor Aimé Huber* (Bremen, 1872-74); Jäger, *Victor Aimé Huber, ein Vorkämpfer der sozialen Reform* (Berlin, 1879).

HUBERT, hū'bẽrt. The custodian of Arthur, in Shakespeare's *King John.* The character is taken from that of Sir Hubert de Burgh, who died in 1243.

HUBERT, ụ'bâr', Saint (?-728). A French bishop, founder of Liège. There are numerous legends concerning him, but there seems no doubt that he was of noble birth and was married to a lady of rank. It is related that the apparition of a crucifix upon the head of a stag which he was chasing one day turned him to the religious life. He became Bishop of Maestricht, and made so many converts in the district that he was called the Apostle of the Ardennes. He is the patron saint of the hunter, and his anniversary is made the occasion of curious ceremonies in French rural districts. Saint Hubert received from heaven a wonderful stole that is said to have retained its miraculous healing properties until the present day.

HU'BERT DE BURGH (?-1243). An English statesman. He held office under Richard the Lion-Hearted, and about 1202 was made, by King John, castellan of Falaise and guardian of Arthur of Brittany, the young son of John's elder brother, Geoffrey. The story of his refusal to obey the King's orders to blind the young prince, incorporated by Shakespeare in his *King John,* is unauthentic. In the struggle between John and the barons he sided with the King, but is mentioned as one of those by whose advice Magna Charta was granted. In the same year he was made justiciar of England. He held Dover Castle against the Dauphin Louis in 1216, and on August 24th of the following year gained a notable naval victory over a French fleet which was bringing in reënforcements to Louis. After 1219, Hubert, with Stephen Langton, Archbishop of Canterbury, carried on the government for the young Henry III. He was a bitter opponent of the foreign party headed by Peter des Roches, Bishop of Winchester, and attempted to put an end to the system by which the wealth of the English clergy was being taxed for the benefit of the Papal Court. His policy in general was dictated by a twofold desire to strengthen the power of the Crown and to further his own fortunes. During his terms of office he amassed vast riches through prudent marriages, as well as by arrogating to himself lucrative offices and the guardianship of wealthy heirs. Members of his family were advanced to high positions in the Church. His ill success against the Welsh about the year 1228 afforded his enemies an opportunity for undermining his influence with the King. He was dismissed from office in 1232, and charged with malfeasance, murder, and treason. Though restored to the King's favor for a short period, he never again exercised any influence in the Government. He died in London, May 12, 1243. Consult Stubbs, *Constitutional History of England,* vol. ii. (4th ed., Oxford, 1896).

HUBERTI, ụ'bâr'tē', Léon Gustave (1843—). A Belgian composer, born at Brussels. He won the Prix de Rome (1865) at the Brussels Conservatory, and from 1874 to 1878 was director of the Mons Conservatory. He was inspector of singing in the Antwerp schools (1880-89), becoming later a professor at the Brussels Conservatory, and director of the music school of St.

Josse-ten-Noode-Schaerbeek. His compositions, which are of sterling merit, comprise: The oratorios, *Een laatste Zonnestraal, Bloemardinne,* and *Willem van Oranjes dood;* the dramatic poem *Verlichting,* for organ, orchestra, soli, and chorus; a *Symphonie funèbre,* a romantic suite, many songs, piano pieces, and instrumental numbers.

HUBERTUSBURG, hụ-bĕr′tụs-b͞o͞orK, or **HUBERTSBURG** (Ger., Hubert's castle). A royal hunting-seat, not far from Leipzig, built in 1721 by Augustus the Strong (Frederick Augustus I.) of Saxony. Here, on February 15, 1763, was signed the treaty of peace between Austria, Prussia, and Saxony, marking the conclusion of the Seven Years' War (q.v.).

HUBLI, or **HOOBLY,** h͞o͞o′blĭ. A town and railway junction in the Dharwar District, Bombay, British India, 90 miles northeast of Karwar on the Malabar coast (Map: India, C 5). It is one of the principal cotton marts in that section of India, and has manufactures of copper ware, silks, etc. The chief objects of interest in the town and vicinity are numerous ancient Jain temples. Population, in 1891, 52,600; in 1901, 58,150.

HÜBNER, hụb′nẽr, ALEXANDER, Count (1811-92). An Austrian author and diplomat, born in Vienna. He held various minor diplomatic positions in Paris, Lisbon, and Leipzig, and was then sent to Paris as Minister Plenipotentiary (1849). He held this post under the Republic, and under Napoleon III. until 1859. After this he was Minister of Police in his own country, but did not keep that portfolio long. From 1865 to 1867 he was Ambassador to Rome, and then made a tour of the world, described in *Ein Spaziergang um die Welt* (1875). His best-known work is *Sixtus V.* (1870).

HÜBNER, EMIL (1834-1901). A distinguished German classical philologist, born at Düsseldorf. He was professor at the University of Berlin from 1870 until his death. His contributions to classical learning, above all in the field of Latin epigraphy, were very numerous. To his influence was due an awakening of interest in classical studies in general, and especially in epigraphy in Spain, which he made a favorite field of study. Among his publications the most important are: *De Senatus Populique Romani Actis* (1859); *Epigraphische Reiseberichte aus Spanien und Portugal* (1861); *Die antiken Bildwerke in Madrid* (1862); *Inscriptiones Hispaniæ Latinæ* (1869, supplementary volume 1892); *Inscriptiones Hispaniæ Christianæ* (1871, supplementary volume 1900); *Inscriptiones Britanniæ Latinæ* (1873); *Inscriptiones Britanniæ Christianæ* (1876); *Exempla Scripturæ Epigraphicæ Latinæ* (1885); *Monumenta Linguæ Ibericæ* (1893); *Ueber mechanische Copien von Inschriften* (1881); *Grundriss zu Vorlesungen über die römische Litteraturgeschichte* (4th ed. 1878); *Grundriss zu Vorlesungen über lateinische Grammatik* (2d ed. 1880); *Bibliographie der klassischen Altertumswissenschaft* (2d ed. 1889); *La arqueología de España* (1888); *Römische Herrschaft in Westeuropa* (1890). Hübner was also co-editor of *Hermes,* 1866-81, and of the *Archäologische Zeitung* (1868-73).

HÜBNER, JULIUS (1806-82). A German historical painter of the Düsseldorf school. He was born at Oels, in Silesia, studied at the Academy School in Berlin and under Schadow, there and at Düsseldorf. He first attracted attention by his picture of "Ruth and Boaz" (1825). He traveled in Italy, and resided for the most part at Düsseldorf until 1839. In that year he settled at Dresden, becoming a professor in the Academy of Arts in 1841, and director of the Gallery of Paintings in 1871. He obtained the great gold medal at Brussels in 1851. Among the works of his first period are "The Fisherman" (1828), after Goethe's ballad; "Ruth and Naomi" (1833), in the National Gallery, Berlin; "Christ and the Evangelists" (1835); "Job and His Friends" (1838), in the Gallery of Frankfort; "Consider the Lilies" (1839); and the portrait of Frederick III., in the Kaiserhalle, Frankfort. To his second or Dresden period belong the "Golden Age" and "Dispute Between Luther and Dr. Eck" (1866), in the Dresden Gallery; "Charles V. at San Yuste," "Last Days of Frederick the Great," "Cupid in Winter," and others. He was also known as a poet.

HÜBNER, KARL (1814-79). A German genre painter, born at Königsberg. He was a pupil of the Düsseldorf Academy. His works were especially popular in Holland and in America, where he went in 1874, and was received with enthusiasm. His genre subjects include: "The Silesian Weavers" (1844); "The Sleeping Wood-Thief" (1845); "The Abandoned" (1846); "The Seizure for Debt" (1848, Königsberg Museum); "The Sinner at the Church Door" (1874, National Gallery, Berlin); "Consolation in Prayer" (1875, Düsseldorf Gallery); and "The Recovery," in the Pennsylvania Academy of Fine Arts.

HUB OF THE UNIVERSE. A name jestingly given by Oliver Wendell Holmes in one of his essays to the State House in Boston as the centre of a self-satisfied community. The term is frequently applied to the city itself, which is popularly supposed to boast of its superior wisdom and culture.

HÜBSCHMANN, hụpsh′män, JOHANN HEINRICH (1848—). A German philologist, born at Erfurt. He studied Oriental philosophy at Jena, Tübingen, Leipzig, and Munich; in 1876 became professor of Iranian languages at Leipzig, and in 1877 professor of comparative linguistics at Strassburg. His principal works are: *Zur Casuslehre* (1875); *Armenische Studien* (1883); *Das indo-germanische Vokalsystem* (1885); *Etymologie und Lautlehre der ossetischen Sprache* (1887); *Persische Studien* (1895); and *Armenische Grammatik* (1895 sq.).

HUC, ụk, ÉVARISTE RÉGIS (1813-60). A French Roman Catholic missionary and traveler. He was born in Toulouse; joined the Lazarist fathers in 1839, and at once went to China. After spending a few years in missionary labor in Northern China, in 1844 he set out for Tibet. With his two companions he spent several months in a Tatar monastery, learning the Tibetan language, and then made his way over the desert and glaciers to Lhasa, arriving in January, 1846. Within a few weeks, however, he was compelled to return, the Chinese ambassador having successfully used his influence to that end. Such was the strain on Father Huc's health that he was forced to come back to France in 1849. He published: *Souvenirs d'un voyage dans la Tartarie, le Thibet et la Chine pendant les années 1844-46* (2 vols., Paris, 1850); *L'empire chinois* (ib., 1855); and *Le christianisme en Chine, en Tartarie et en Thibet* (4 vols., ib., 1857-58). All of these works have been translated into English. The strangeness of the things described caused them to be received with incredulity, but later travelers have established their truth. Father Huc's health was never fully restored, and he died at the age of forty-six. Consult: Henri d'Orléans, *Le père Huc et ses critiques* (Paris, 1893).

HUC′BALD, or **HUBAL′DUS** (c.840-c.930). A Benedictine monk, author, and musician. He was noted for his piety and learning. He lived most of his life in the Monastery of Saint-Amand, near Tournay. His writings include some lives of the saints, but he is best known by his treatises on music. The authorship of these is disputed, excepting *Harmonica Institutio*, a criticism of a work by Reginon de Prum. The most celebrated of them is *Musica Enchiriadis*, now believed to be by an unknown writer of the end of the tenth century. It illustrates rules by practical examples, and is a valuable aid to the understanding of certain early systems of notation. Other works attributed to him are *Alia Musica* and *Commemoratio Brevis de Tonis et Psalmis Modulandis.*

HUCKABACK (probably from LGer. *hukkebak*, pickaback, from *huken*, to crouch + *bak*, back). A coarse kind of linen or cotton cloth, figured somewhat like damask; it is usually employed for toweling.

HUCKLEBERRY (probably a corruption of *hurtleberry*, *whurtleberry*, *whortleberry*, probably from AS. *wyrtil*, OHG. *wurzala*, Ger. *Wurzel*, root + *berry;* apparently confused with AS. *heortberge*, *heorotberge*, hartberry, from *heort*, *heorot*, stag, hart + *berge*, berry). A term now applied indiscriminately to various small, hardy shrubs of the genus Vaccinum (order Vacciniaceæ). The flowers of these plants have a four or five toothed calyx, four or five cleft bell-shaped corolla, with the limb bent back, and eight to ten stamens with two-horned anthers. The fruit is a four to five celled, many-seeded berry. The numerous representatives of the genus, mostly confined to the Northern Hemisphere, are common in the north of Great Britain, Europe, and throughout North America. In nature the huckleberry is represented by numerous species, and as each of these show marked variations in size of fruits and productiveness, the wonder is that so attractive a native plant should have existed so long apparently unheeded. The plants range in size from six inches in Vaccinum Pennsylvanicum, to five to ten feet high in Vaccinum corymbosum, and bear fruits from one-eighth inch up to five-eighths inch in diameter. In color they are equally variable, showing all shades from waxen black, blue, and white, to red in one species, Vaccinum Vitas-Idæa, which is often called cranberry because of the likeness of its acid fruit to that of the cranberry.

HUCKLEBERRY.

While the huckleberry has been successfully transplanted to gardens, grown from seeds and grafted, it has nowhere been cultivated in a commercial way. In certain portions of the United States wild plants are protected and cared for in order that the fruit may be secured for the canneries or markets. The "blueberry barrens" of Maine, an area of some 150,000 acres in extent, is a notable example of the preservation of a native product from which is derived a large annual income. The annual pack from this region alone is about 30,000 cases of 24 cans each, valued at $57,000. Besides forming a valuable commercial product when canned, the huckleberry is extensively gathered and marketed for dessert purposes. Although naturally a dry, rather seedy fruit, the larger specimens are juicy, and possess a most agreeable flavor. The huckleberry is also used for preserves and jellies, as well as for making wine and distilled liquors. In America, however, its chief value is as a dessert fruit, both in a fresh state and when canned.

HUCKNALL TORKARD, hŭk′n*a*l tôr′kẽrd. A town in Nottinghamshire, England, five miles north of Nottingham (Map: England, E 4). It has coal-mining industries. Lord Byron is buried in the old parish church. Population, in 1891, 11,000; in 1901, 15,250.

HUDDE, hŭd′d*e*, ANDREAS (c.1600-63). A Dutch commander in New Netherland after 1629. As one of the four councilors of Wouter van Twiller, director-general in America for the Dutch West India Company (1633), Hudde obtained a large grant of land upon Long Island, and in 1642 he was surveyor of Manhattan. Four years later, when trouble had arisen between the Dutch and Swedish settlers on the South, or Delaware River, he was sent to guard the Dutch West India Company's interests there, and at once entered into strife with the governor of the Swedes, who tried to stir up the Indians against him. But Hudde held his own until 1655, when the Dutch authorities sent ships to help him, and he conquered the Swedish rulers. He continued to enjoy the company's confidence, and was made commander of Forts Altona and New Gottenburg (1657), as well as colonial surveyor and parish clerk. That he was a well-educated man is evidenced by the quality of his literary remains in the Albany archives.

HUD′DERSFIELD. A manufacturing and market town in the West Riding of Yorkshire, England, on the Colne, 16 miles southwest of Leeds. It has excellent facilities for intercommunication by railway and canal with all important commercial centres, and is the chief seat of the English cloth and woolen manufacture (Map: England, E 3). Coal-mining and stone-quarrying are also profitable industries. The town is well built, with spacious thoroughfares, and fine ecclesiastical, public, and commercial buildings. The town hall and market hall are noteworthy. It has a proprietary college affiliated to the London University, a collegiate school, and other educational institutions. Its municipal government is of a high order and the corporation has been a pioneer in several economic features. Artisans' dwellings were established in 1853 for married couples, and for single women as well as for bachelors. Huddersfield was the first to own and work its tramways; it owns its gas, water, and electric works, and several beautiful parks; maintains free public libraries, an art gallery, public baths and wash-houses, slaughter-house, markets, technical schools, fire brigade, a hospital, cemeteries, and a modern system of refuse and sewage disposal. It was the first town to adopt an eight-hour labor day. It is the seat of a United States consulate. Although a town mentioned in the Domesday Book, its importance dates only from the establishment of the woolen manufacture in the eighteenth century. Population, in 1891, 95,400; in 1901, 95,000.

HU'DIBRAS. See BUTLER, SAMUEL.

HUDIBRAS, SIR. A foolhardy and pessimistic character, the suitor of Perissa, in Spenser's *Faerie Queene*, probably meant to represent Puritanism.

HUD'SON. A town in Middlesex County, Mass., 28 miles west of Boston; on Assabet River, and on the Fitchburg and the Boston and Maine railroads (Map: Massachusetts, D 3). It has a public library. There are manufactures of leather, leather and rubber shoes, rubber gossamer clothing, rubber goring and webbing, and wooden and paper boxes. The government is administered by town meetings. The water-works and electric-light plant are owned and operated by the town. Population, in 1890, 4670; in 1900, 5454.

HUDSON. A city and the county-seat of Columbia County, N. Y., 28 miles south of Albany; on the east bank of the Hudson River, and on the New York Central and Hudson River, the Boston and Albany, and other railroads (Map: New York, G 3). It is finely situated on the slope of Prospect Hill, and has a number of noteworthy buildings, the State House of Refuge for Women, State Volunteer Firemen's Home, Hudson Orphan Asylum, State Armory, and the court-house, city hall, and city hospital. Public Square and Franklin Square parks, and Promenade and Reservoir hills are also of interest. There are extensive manufactures of knit goods, car-wheels, ale, lumber, tobacco, iron, machinery, stoves, furnaces, etc. Under a charter of 1895, the government is administered by a mayor, elected biennially, and a city council. The water-works are owned and operated by the municipality. Population, in 1890, 9970; in 1900, 9528. Hudson was settled as Claverack Landing by New Englanders in 1783; its present name was adopted in 1784, and a city charter was received in 1785. For some years the city carried on an extensive foreign trade, and was an important whaling port, but its shipping was almost completely destroyed in the War of 1812.

HUDSON. A city and the county-seat of Saint Croix County, Wis., 19 miles east of Saint Paul, Minn.; on Lake Saint Croix, an expansion of the Saint Croix River, and on the Chicago, Saint Paul, Minneapolis and Omaha Railroad (Map: Wisconsin, A 4). It has saw and flour mills, box, furniture, and broom factories, breweries, railroad car and machine shops, and also a large cold-storage plant, the city being the centre of a region that is interested in raising vegetables, small fruits, poultry, etc., for shipment. There is a well-equipped sanatorium. The water-works and electric-light plant for street lighting are owned by the municipality. Population, in 1890, 2885; in 1900, 3259.

HUDSON, CHARLES (1795-1881). An American clergyman, politician, and author, born in Lexington, Mass. He was educated for the Church, which he entered as a Universalist in 1819, and he presided over a congregation in Westminster, Mass., until 1839. Beginning his political career in the House of Representatives in his own State, he afterwards went to Congress (1841-49), and then was made naval officer at the port of Boston, a position he retained four years, and then exchanged it for others in the public service. Besides editing a Boston daily newspaper, he wrote much upon historical and political topics for the periodical press. His books include: *Letters to Rev. Hosea Ballou* (1827); *History of Westminster* (1832); and a *History of Lexington* (1868), with a genealogical register of its families.

HUDSON, ERASMUS DARWIN (1843-87). An American physician, born in Massachusetts. He graduated at the College of the City of New York in 1864, and at the College of Physicians and Surgeons, New York City, in 1867. During 1867-68 he was house surgeon at Bellevue Hospital. In 1869-70 he was health inspector of New York City; in 1870 was attending physician to the class for diseases of the eye in the out-door department of Bellevue Hospital; was attending physician at Northwestern Dispensary in 1870-72, and attending physician to Trinity Chapel parish and Trinity Home in 1870-75. He was appointed professor of principles and practice of medicine at the Woman's Medical College of the New York Infirmary in 1872, and held that position for ten years; and from 1882 until his death was professor of general medicine and diseases of the chest in the New York Polyclinic. He was the author of the following professional works: "Report of Pulse and Respiration of Infants," in Eliot's *Obstetric Clinic* (1872); *Doctors, Hygiene and Therapeutics* (1877); *Methods of Examining Weak Chests* (1885); *Limitations of the Diagnosis of Malaria* (1885); *Home Treatment of Consumptives* (1886); and *Physical Diagnosis of Thoracic Diseases* (2d ed. 1887)

HUDSON, FREDERIC (1819-75). An American journalist, born in Quincy, Mass. After a common-school education he went to New York City in 1836, and became attached to the New York *Herald*, of which he soon became managing editor, which position he held until 1866. His long experience and diligence in collecting gave him abundant material for his *Record of Journalism in the United States from 1690 to 1872*, published in 1873, which is perhaps the most accurate and interesting history yet published of the rise and development of the American newspaper.

HUDSON, George (1800-71). An English speculator, known as the 'railway king.' He acquired a fortune as a linen-draper, and at the age of twenty-seven inherited £30,000. Investing in railways, he soon carried out large schemes of annexation and extension, crushing roads and buying up embarrassed lines. He was three times elected Lord Mayor of York, and was sent to Parliament. In 1847 the value of railway property fell rapidly, and it was found on investigation that Hudson was paying dividends out of capital, and appropriating large sums to his personal use. He spent his last twenty years in contesting lawsuits.

HUDSON, Henry (?-1611). An English navigator. He is first mentioned as the commander of the ship *Hopeful*, sent in May, 1607, by the Muscovy Company in quest of a northeast passage to the Spice Islands. After a voyage of four and a half months, during which he touched the coasts of Greenland and Spitzbergen, and sailed as far north as 80° 23′, he returned to England. The next year he sailed again under the auspices of the Muscovy Company, and reached Nova Zembla, attempting in vain to force a passage through the Vaigatch or Kara Strait, in the expectation of finding himself within easy reach of the Pacific. This voyage proved as unsuccessful as the first. His next undertaking was made in behalf of the Dutch East India Company. In their employ he sailed from Amsterdam on March 25, 1609, with two ships, the *Good Hope* and the *Half Moon.* He made Nova Zembla, intending to try again the passage of the Vaigatch, but his crew rebelled, and the *Good Hope* returned to Holland. Hudson, in the *Half Moon*, crossed the Atlantic, and sighted land in the latitude of Nova Scotia. He then sailed south as far as latitude 35°, and again turning north, carefully examined the coast up to Sandy Hook, which he reached on September 12th. A month was spent in exploring the Hudson River, which the *Half Moon* ascended to the present site of Albany. He reached England on November 7th, having satisfied himself that the story of a great strait leading through the continent somewhere in the latitude of 40° was false. In 1610 he set out once more, this time to search for a northwest passage under the patronage of an association of English gentlemen. He left England in April, and by June 10th had reached the strait which now bears his name. Passing into the bay beyond (Hudson Bay), he spent three months in exploring its coasts and islands. Early in November his vessel was frozen in. The winter seems to have been one of great suffering. Provisions were scarce, and dissensions arose among the sailors. Late in June, 1611, a part of the crew mutinied, seized and bound Hudson, his son, and seven others of the ship's company, and putting them into the small boat, set them adrift. They were never seen again. A few wretched survivors from among those on board the ship reached England. For an account of Hudson, consult the introduction to Asher, *Henry Hudson, the Navigator*, edited for the Hakluyt Society (London, 1860). The volume includes reprints of the earliest accounts of his voyages, both English and Dutch.

HUDSON, Henry Norman (1814-86). An American Shakespearean scholar and editor, born at Cornwall, Addison Co., Vt. In early life he worked as a baker and a wheelwright. He graduated from Middlebury College, Vermont, in 1840, and then taught school in Kentucky and Alabama. He presently became an authority of considerable note on Shakespeare, lectured widely on his works, and was appointed a professor in Boston University. Among his works in this field are: *Lectures on Shakespeare* (2 vols., 1848); a valuable annotated edition (11 vols., 1851-56); and *Shakespeare: His Life, Art, and Characters* (2 vols., 1872). Having entered the priesthood of the Protestant Episcopal Church, he was for some years editor of the *Churchman;* was rector at Litchfield, Conn., 1859-60, and served as chaplain in the Union Army during the Civil War. On his return he published *A Chaplain's Campaign with General Butler* (1865). He was author also of *Sermons* (1874); *Studies in Wordsworth* (1884); *Essays in Education* (1884); and other works.

HUDSON, William (c.1730-93). An English botanist, born at Kendal. He became an apothecary, but devoted much time to botany, entomology, and other natural sciences. He is chiefly noted for his adaptation of the Linnæan system of plant classification to the flora of Britain, which he published under the title, *Flora Anglica* (1762). A second and greatly enlarged edition appeared in 1778. The genus Hudsonia was named by Linnæus in his honor.

HUDSON, William Henry (1863—). An English author and professor of English literature, born in London, and educated by private tutors. He was private secretary to Herbert Spencer, librarian of Sion College, London (1885-86), and later of the London City Liberal Club (1889-90), and of Cornell University (1891-92). From 1892 to 1901 he was professor of English literature at Leland Stanford, Jr., University. His principal works, besides contributions to magazines, are: *The Church and the Stage* (1886); *An Introduction to the Study of Herbert Spencer* (1893); *Studies in Interpretation* (1896); *Idle Hours in a Library* (1897); *The Study of English Literature* (1898); *Sir Walter Scott* (1900); *The Sphinx, and Other Poems* (1900); *The Satan of Theology* (1901); and editions of Goldsmith's *Vicar of Wakefield* (1898) and of the *Roger de Coverley Papers* (1899).

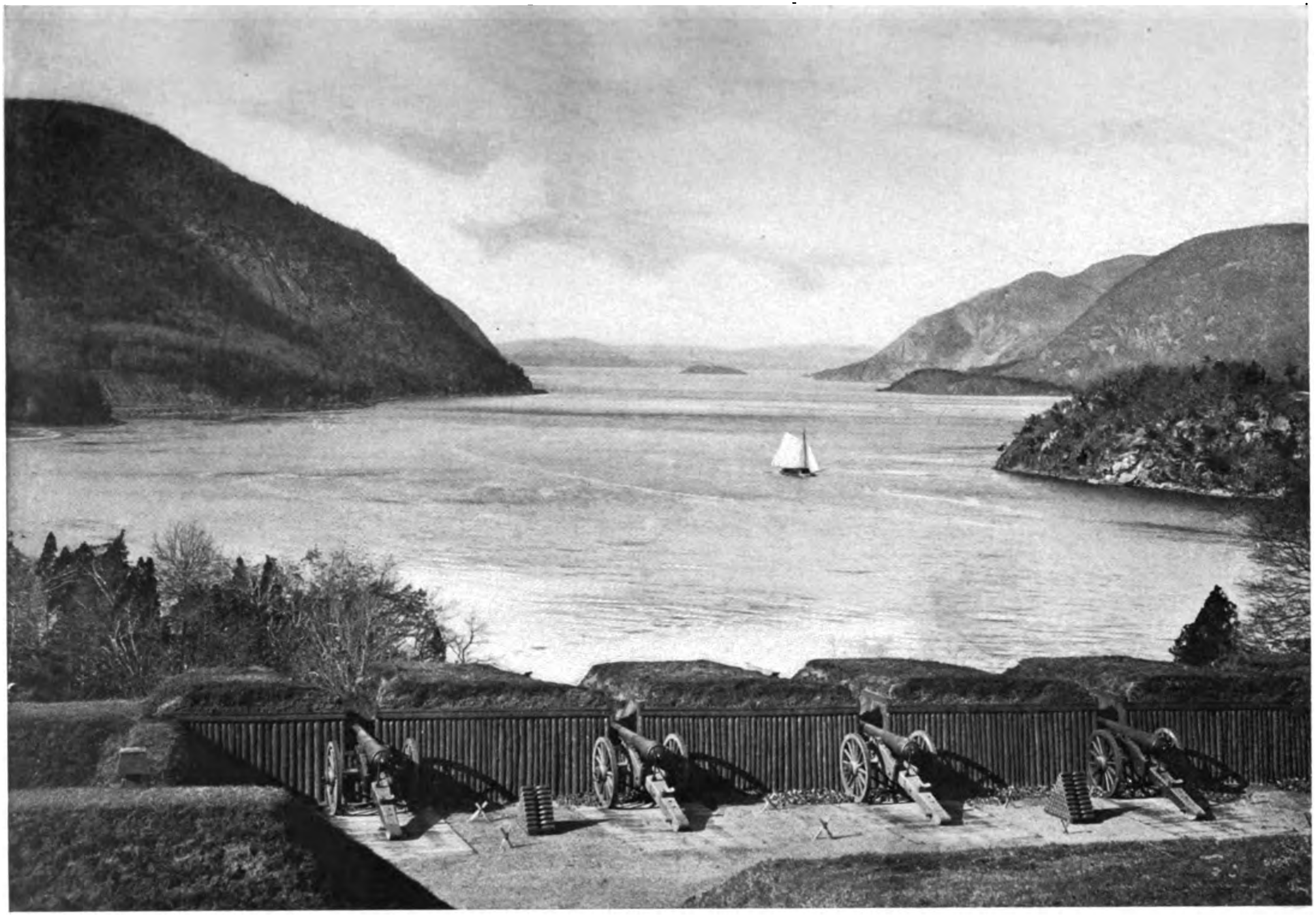
HUDSON BAY. A spacious landlocked gulf in the northeastern section of Canada, which may be regarded as an arm at once of the Arctic and the Atlantic oceans (Map: North America, K 3). It communicates with the Atlantic by means of Hudson Strait, and with the Arctic by Fox Channel and various passages to the north and west, which, notwithstanding the comparative lowness of their latitude, have proved less practicable for navigation than the Arctic Ocean itself. Hudson Bay extends from about latitude 51° to about 64° N., a distance of about 900 miles. Its area is about 400,000 square miles. Its depth is about 70 fathoms; on the west coast there is an average rise and fall of 11 to 12 feet at spring tides. The southern prolongation of Hudson Bay bears the name of James Bay. Hudson Bay contains several islands, in addition to the large Southampton Island at its north end, but no rocks or shoals, and the region is singularly free from storm or fogs. Neither the bay nor Hudson Strait is ever entirely frozen over, but both are beset by detached floes and bergs of ice, which render navigation difficult for sailing vessels. Steamships can make the voyage up the bay and reach land from about the middle of June to the end of October. The west shore lies low, but the east shore is bold and rocky. Thirty rivers of considerable magnitude flow into the bay, the Nelson River being the most important. The Churchill and the Severn come next, the former having a deep though comparatively narrow mouth, which can be entered with ease by the largest ships at all tides. Though the land lying south and west of James Bay is suitable for dairy farming, and though ironstone, manganiferous iron ore, galena, and plumbago are found in other portions of the surrounding territory, neither the soil, timber, nor minerals have been to any extent drawn upon. Whale, walrus, seal, and salmon abound in the waters of Hudson Bay, and steam whalers visit it during the summer; but the only business which has been developed lucratively is the fur trade by the Hudson's Bay Company. This may be accounted for by the severity of the long winter on the shores of the bay. The few summer months are marked by a genial and bracing climate. The bay was discovered in 1610 by Henry Hudson (q.v.).

HUDSONIAN CURLEW, GODWIT, etc. See CURLEW, GODWIT, etc.

HUDSON RIVER. The principal river of New York State, and one of the most picturesque and important waterways in the Eastern United States (Map: New York, G 3). It rises in the Adirondack Mountains in the northern part of the State, receiving the waters of most of the lakes in the southeastern half of the Adirondack region, and having its ultimate source in a small lake near the outlet of Long Lake in the northeastern part of Hamilton County. After passing through these mountains in a number of windings, it flows almost due south until it empties into the Atlantic Ocean through New York Bay at New York City. Throughout its course it receives only three considerable tributaries, the Sacondaga, Mohawk, and Wallkill, all from the west. The scenery along the Hudson is of remarkable beauty and grandeur, and with the number of places on its shores celebrated in history and literature, the river justly merits the title of the 'Rhine of America.' Like the other Atlantic rivers, it breaks transversely through the Appalachian ridges instead of following what would now be the natural course along the great longitudinal valleys. (See APPALACHIANS, especially under the sub-head *Drainage Development.*) Accordingly, its valley is in places very narrow, and its banks lined with high and steep hills or mountains, notable among which are the Highlands, 1500 feet in elevation, through which the river winds in a highly picturesque gorge, narrowed at one point to about 1600 feet. Farther down, near the mouth, its western shore, for about 18 miles, is formed by a great dike of trap rock, the famous Palisades (q.v.), rising perpendicularly from the water's edge to a height of 300 to 500 feet. The Catskill Mountains, west of the Hudson, about 100 miles from the sea, approach to within 8 miles of the river.

The Hudson differs from the other Atlantic rivers in the fact that, owing to the considerable sinking or depression of the land which has been going on in this region, its valley has been drowned and tide-water admitted nearly 100 miles beyond the gorge of the Highlands as far as Albany. Below this point the so-called river is really an estuary or fiord, its volume being far out of proportion to its drainage area, though, owing to the narrowness of its valley, it still retains the aspect of a river, except for a stretch of about 20 miles between the Highlands and the Palisades, where it expands into Haverstraw Bay and Tappan Sea, the latter over 3 miles wide. Above Albany and Troy the river is really a small stream, obstructed by falls and rapids. It is this drowning of the Hudson Valley which is one of the principal causes of the commercial supremacy of New York City, as it has made this river the only deep-water passage cutting entirely through the Appalachian system. The connection of the Atlantic with the North Central States is completed by the Erie Canal (see CANAL), which extends from Troy to Buffalo on Lake Erie. The Hudson Fiord, as it may be called, is a majestic waterway, from one-half to nearly one and one-half miles wide, with the exceptions noted above. It is navigated by a large number of vessels of all kinds, and elegant passenger steamers ply upon its waters. The principal places on the river are Glens Falls, Cohoes, Troy, Albany, Hudson, Catskill, Kingston, Poughkeepsie (where is the only bridge between Albany and the sea), Newburgh, West Point (seat of the United States Military Academy), Peekskill, Haverstraw, Ossining (Sing Sing), Nyack, Tarrytown, Yonkers, and at the mouth of the river, New York, Hoboken, and Jersey City. The sailing craft, however, whose numbers formerly added so much to the picturesqueness of the river, have to a great extent disappeared. The enormous traffic is further facilitated by the New York Central and Hudson River and the West Shore railroads, which run along either shore of the Hudson and the Mohawk. The navigable length of the Hudson from New York to Troy is 150 miles, and the entire length of the river is about 300 miles. It was discovered by Verrazano in 1524, but first explored by Henry Hudson in 1609. It was called North River to distinguish it from the Delaware, or South River, but the English named it in honor of its explorer. Its Indian name was Shatemuc. The Hudson figured prominently in the Revolutionary War (see STONY POINT; WEST POINT), and it was on this river that steam navigation was first successfully introduced by Robert Fulton in 1807.

HUDSON RIVER SCHOOL OF PAINTING. So called from the work produced by a number of American artists who found their subjects largely in the neighborhood of the Hudson River. Some of them lived on its banks, and the father of this group of painters was probably Cole (q.v.), who lived at Catskill. The Hudson certainly furnished charming subjects for the landscape painter's brush; but as it was exploited in art rather early in the art development of our country, it seemed to have been regarded by artists of the day as offering pictorial opportunities, rather than any grand and dramatic expressions of nature. This latter, however, it does at times present, but these phases have not been made much of by the 'school,' those painting along its shores prefer-



THE HUDSON RIVER
LOOKING NORTH FROM WEST POINT

ring rather the gentle and idyllic charms where haze and sunshine and autumnal coloring have softened its landscape to an almost cloying sweetness. For this reason, a later and more robust set of painters have been disposed to use the term as one of gentle reproach, and indicating that scant justice has as yet been done this noble river. Among those who have invested this class of subject with considerable charm may be mentioned J. F. Kensett, Sanford R. Gifford, J. B. Bristol, Worthington Whittredge. J. R. Brevoort, and J. F. Cropsey. The influence of the school has not been lasting.

HUDSON RIVER SERIES. See ORDOVICIAN SYSTEM.

HUDSON'S BAY COMPANY. An English chartered company. It was incorporated in 1670, by Charles II., who granted to a number of 'adventurers,' with Prince Rupert at their head, the sole right to trade with the native tribes on the shores of Hudson Bay. The company had power to establish laws and impose penalties, to erect forts, maintain ships of war, and "make peace and war with any prince or people not Christian." It started with a capital of about £110,000, and for a long time it maintained its monopoly intact. The progress made was not rapid, and by the middle of the eighteenth century the company had no more than 120 people in its employ; but nevertheless three or four ships were sent out annually with a cargo of coarse English goods, which were sold to natives for furs and skins at rates which brought the proprietors a handsome profit. Conflicts soon arose with the French, who laid claim to the territory on the ground of an expedition made in 1656 by Jean Bourdon, who, according to Charlevoix, *Histoire de la Nouvelle France*, vol. i. (Paris, 1744), traveled from Quebec to Hudson Bay and took formal possession of the country inclosing James Bay. There is no doubt, however, that the Hudson basin had been visited by English navigators long before 1656. In 1682 a trading post on the coast was surprised by the French, and in 1686 four more of the company's forts were taken. During the war of 1689-97 the same forts changed hands more than once, and by the terms of the Peace of Ryswick some of them were given to the French. It was not until the Treaty of Utrecht, in 1713, that the latter finally resigned all claims to the Hudson Bay territory. From 1713 to 1763 the company enjoyed a peaceful and prosperous, but far from dazzling, career. It imported annually into England about 30,000 skins, and its dividends were 8 to 10 per cent. The conquest of New France was the turning-point in the company's history. When Canada became English, the vast territory of the Hudson's Bay Company became accessible from the south as well as from the sea. Trade increased tremendously, and in the next French war (1778-83), when its factories were surprised by a French squadron under Lapérouse, the company was strong enough to bear a loss of £500,000.

So profitable a monopoly could not be long enjoyed. Not only private trappers, but rival companies, entered the field, on the principle of free and open trade guaranteed to all British subjects in the Declaration of Rights. Such a competitor was the famous Northwest Company, which, after years of strife amounting at times to actual war, was merged (1821) with its opponent under the name 'Adventurers of England Trading into Hudson's Bay,' for a period of twenty-one years. The territories of the company had been gradually extended until they reached to the Arctic on the north and the Pacific on the west. In 1859 the trade monopoly was abolished, but the claims of vested interests and property rights remained unsettled until 1869, when, in return for an indemnity of £300,000, together with a land grant of 7,000,000 acres made by the Dominion Government, the company gave up all its ancient privileges, and took its place on a footing with other business corporations, retaining, however, its forts or trading stations. The company's influence with the Indians has always been very great, and it has been served by a corps of well-trained agents who still in large measure administer justice and preserve order among the native tribes. Information regarding the Hudson's Bay Company may be found in Cawston and Keane, *Early Chartered Companies* (London, 1896). Consult also: Bryce, *History of the Hudson Bay Company* (London, 1900); Willson, *The Great Company* (London, 1900); Bradley, *Fight with France for North America* (New York, 1901). An account of the Northwest Company is given in Washington Irving's *Astoria*.

HUDSON STRAIT. See HUDSON BAY.

HUÉ, hōō-ā'. Capital of the Kingdom of Annam, situated on the left bank of the Truong River, about 10 miles above its entrance into the sea, about latitude 16° 29′ N., and longitude 107° 38′ E. (Map: French Indo-China, E 3). It is a walled city, fortified in the beginning of the nineteenth century by French engineers after the style of Vauban. Hué consists of two parts, the city proper and the suburbs, the former being in the middle of a square island separated from the suburbs on three sides by the river and on one side by a canal. The walls, which have a circumference of about 8000 yards, are of brick and very high, and the citadel has eight gates. The royal palace has yellow tiles on the roof; those of the nobles have red tiles. The wall inclosing the royal palaces has three gates, the centre one being in the form of a pagoda, elaborately carved and gilded; but most of the public buildings and nearly all the houses are comparatively mean and in bad repair. Population about 100,000, of whom 800 are Chinese and 350 Europeans, the latter consisting for the most part of the French Resident, his staff and military guards. The forts at the river mouth were taken by the French in 1883.

HUE, ụ, GEORGES ADOLPHE (1858—). A French dramatic composer. He was born at Versailles, and gave early evidence of his musical gift. When twenty-one years of age he won the Grand Prix de Rome, and two years later the Prix Cressent. During his period of study at the Paris Conservatory he was the pupil of Reber and Paladilhe. His compositions include the following operas: *Les Pantins* (1881); *La belle au bois dormant* (1894); *Vazanta;* and *Le roi de Paris*. Among his orchestral works are the symphonic legend, in three parts, *Rübezahl*, and a dramatic sacred episode, *Resurrection*. He also wrote much chamber music, and numerous pieces for individual instruments. He was one of the most successful teachers in Paris.

HUE AND CRY. A phrase, derived from the old process of pursuit with horn and voice, used in English law to describe the pursuit of felons. Whoever arrested the person pursued was so far protected that he required no warrant to justify the arrest; and even if the party turned out to be no felon, no action could be brought if the arrest was bona fide. But it was not only a ground of action, but an offense subject to fine and imprisonment, maliciously and wantonly to raise the hue and cry against a person. It was the duty of all persons to join in a hue and cry, and if a person who had been robbed, or knew of a robbery, failed to raise the hue and cry, he was liable to fine or imprisonment, or, according to some authors, to indictment. Hue and cry is now regulated in England by the Sheriffs Act, 1887 (50 and 51 Vict., c. 55). Consult: the *Commentaries* of Blackstone; Pollock and Maitland, *History of English Law* (2d ed., London and Boston, 1899).

HUEFFER, hụf′fẽr, Francis (1843-89). An English musical writer and librettist, born in Münster, Germany. He studied in England and on the Continent, and afterwards settled in London, and became musical critic of the *Times* in 1878. He furnished the libretto for the operas *Columbia* and *The Troubadour* of Mackenzie, and *The Sleeping Beauty* of Cowen. His works include an edition of the works of the troubadour Guillem de Cabestant (1868); *Richard Wagner and the Music of the Future* (1874); *The Troubadours: A History of Provençal Life and Literature in the Middle Ages* (1878); *Musical Studies* (1880), a collection of articles originally written for the *Times* and other newspapers, translated into Italian by Visetti (1883); and a translation into English of the correspondence of Wagner and Liszt. He was one of the first to advocate the cause of national English opera.

HUELEN, wā′lān (c.1540-1603). A Chilean patriot, native of Angol. In 1599 he was at the head of the forces of Araucania, mustered to repel the Spaniards, and by copying their methods and teaching his followers to ride the horses the invaders had brought to South America, was enabled to wage successful warfare against them, though no longer a young man. He was victorious at Valdivia (1599), near Concepción (1601), near Bio-Bio (1602), against the enemy with firearms and coats of mail; but his siege of Osorno failed, and he died of old wounds and new before he had succeeded in capturing the fort.

HUELVA, wȧl′vȧ. The capital of the Spanish province of the same name, situated on the deep and navigable estuary of the Odiel River, 10 miles from its mouth in the Gulf of Cadiz (Map: Spain, B 4). It is a well-developed town, with a good harbor, and is a railroad centre. Among its buildings is a fine hotel built in 1883 by an English company. There are also several notable churches, that of San Pedro having formerly been a Moorish mosque. The Roman aqueduct has been restored, and after centuries of disuse, again supplies the city with water. The industries and commerce of the city have become very important, through the exploitation on a large scale of the copper-mines of the province. The mining companies have built two large iron piers at the harbor, one of them costing $780,000. The city has also large machine-shops and shipyards, as well as various other industries. The United States is represented by a consular agent. Population, in 1900, 20,927.

HUENE, hụ′ne, Karl, Baron von Hoiningen (1837-1900). A German politician, born in Cologne, and educated in Berlin. He entered the army, and after serving in the wars of 1864, 1866, and 1870-71, became a member of the Prussian House of Deputies (1877). In 1884 he was elected to the Reichstag, where he rose to prominence as a leader of the Centre, and author (1885) of the *Lex Huene*, rescinded in 1893, by the terms of which all taxes on cereals and cattle, save 15,000,000 marks, were divided among the various parochial governments of Prussia. In 1893 he lost his leadership of the Clericals by his compromise with the Administration on the military budget, and failed of reëlection in that year, and again in 1895. But until his death he remained a member of the Prussian Council of State, to which he had been appointed in 1890.

HUEPPE, hụp′pe, Ferdinand (1852—). A German bacteriologist, born at Heddesdorf, and educated in Berlin. In 1890 he was appointed professor of hygiene in the German University at Prague. He established the fact that subterraneous water is free from germs, and contended that the source of infection from bacteria is the decayed organism on which the bacillus feeds. Hueppe did much to simplify disinfection and to promote inoculation with 'benign' bacteria. He first advanced the theory that the power of 'nitrifying' microbes to absorb carbonic oxide, even in the dark, is due to the oxidation accompanying the ammoniacal preparation of saltpetre. He wrote: *Die Formen der Bakterien* (1886); *Ueber die Beziehungen der Fäulnis zu den Infektionskrankheiten* (1887); *Ueber den Kampf gegen die Infektionskrankheiten* (1889); *Die Methoden der Bakterienforschung* (5th ed. 1891); *Die Choleraepidemie in Hamburg, 1892* (1893); *Ueber die Ursachen der Gärungen und Infektionskrankheiten* (1893); *Naturwissenschaftliche Einführung in die Bakteriologie* (1896); *Zur Rassen- und Socialhygieine der Griechen* (1897); and *Handbuch der Hygieine* (1899).

HUÉRCAL-OVERA, wār′kȧl ō-vä′rȧ. A town of Southeastern Spain, in the Province of Almeria, situated in a broad and fertile valley surrounded by mountains, 16 miles from the Mediterranean coast (Map: Spain, D 4). It has straight and wide streets and several plazas, on one of which stands a handsome church. The town is connected by rail with Murcia, and between it and the coast are the silver and copper mines of the Sierra de Almagrera. Population, in 1900, 15,774.

HUERTA, wār′tȧ, Vicente García de la (1734-87). A Spanish poet and critic. He was born at Zafra, in Estremadura, and spent the greater part of his life in Madrid, where he held the office of principal librarian of the Royal Library, and where he died. He early distinguished himself by his poetic talent. His tragedy *Raquel*, founded upon the story of the love of King Alfonso VIII. for the Jewess Rachel, was received with great enthusiasm when first produced in 1778, and is still considered a work of some merit. Huerta was a most zealous, but not always a wise or skillful, defender of the ancient Spanish national taste against the Gallicism which then prevailed. His shafts were directed especially against the French school of dramatists and lyric poets inaugurated as a result of Luzan's crusade. As a lyric and dramatic poet he shows great command of language and versification. His poems were published in two volumes, *Obras poéticas* (1778-79); they are accessible in the *Biblioteca de autores españoles*, vol. lxi. (Madrid, 1869). Huerta edited the *Teatro español* (17 vols., Madrid, 1784-85), a collection of the best works of the older Spanish dramatists.

HUESCA, wȧ'skä (Lat. *Osca*). The capital of the Spanish province of the same name, situated in a fertile plain on the River Isuela, 45 miles northeast by rail from Saragossa (Map: Spain, E 1). It is an old town, retaining its mediæval aspect, surrounded by the ruins of its double line of ancient walls. It has a celebrated Gothic cathedral dating from the fifteenth century, in which is a magnificent alabaster tablet, representing the Passion; and an old Romanesque church dating from the twelfth century. There are also several old monasteries in the neighborhood, that of Monte Aragón containing in its crypt the tomb of Alfonso I. The institute for secondary education occupies the building of the old university, founded in 1354, and removed to Saragossa in 1845. In one of the vaults of this building the famous 'Bell of Huesca' is said to have been constructed from the sixteen heads, including one as the clapper, of as many insurgent nobles, who were executed by command of King Ramiro II. Population, in 1887, 13,041; in 1900, 11,976. Under the Romans Osca was a place of considerable importance, having a number of Greek and Latin schools and a college founded by Sertorius, who here met his death at the hands of Perpenna in B.C. 72. The Moors strongly fortified Huesca; after being taken by Pedro I. in 1096 it became the capital of Aragon, but was superseded by Saragossa in 1118.

HUÉSCAR, wȧ'skär. A city in the Province of Granada, Spain, situated 75 miles northeast of the city of that name (Map: Spain, D 4). It has manufactures of flour, paper, linen, and woolen goods. Population, in 1900, 7917.

HUET, ụ'ȧ', PAUL (1804-69). A French landscape painter, born in Paris. He was a pupil of the Ecole des Beaux-Arts (1820-24), and of Gros and Guérin, and was himself the founder of the new school of romantic painting (1831), which opened the way for Dupré and Rousseau. Many of his pictures are owned by the French museums—the Luxembourg possesses two of them, "Une matinée dans la fôret" (1835) and "La vallée de la Touque." His other works include: "Le Château d'Arques" (1840); "Le coup de vent;" "Vue de Naples;" "Les ruines du château de Pierrefonds;" and "Vue de Rouen" (1833). His landscapes are treated in the romantic manner, with stormy sombre skies, and intense coloring. Consult Burty, *Paul Huet* (Paris, 1869).

HUET, PIERRE DANIEL (1630-1721). A French Roman Catholic scholar. He was born at Caen, February 8, 1630, and was educated in the Jesuit School there. He was a zealous follower of Descartes and a pupil of Bochart, and accompanied the latter on his visit to Stockholm in 1652. On his return to Caen he gave himself up entirely to study; and as a preliminary to his translation of the text of Origen, he published his *De Interpretatione* (1661), but it was only at the end of fifteen years' study that he published his edition of Origen's *Commentaria in Sacram Scripturam* (1668). In 1670 he was summoned to Paris to take part with Bossuet in the education of the dauphin. In 1679 he published his *Demonstratio Evangelica*. He had an active part, moreover, in the Delphin edition of the classics. In 1674 he was elected a member of the French Academy. In 1676 he entered into holy orders; and in 1678 was named abbot of the Cistercian abbey of Aulnay, from which place is named his work, *Alnetanæ Quæstiones de Concordia Rationis et Fidei* (1690). In 1691 he published in Latin a work on *The Situation of Paradise* (Eng. trans. 1694); another in 1693 *On the Voyages of Solomon*, which were followed later by his work in classical geography, *History of the Commerce and Navigation of the Ancients*, in French (1716; Eng. trans. 1717). In 1685 he was named Bishop of Soissons, a dignity, however, on which he never entered, being transferred to the See of Avranches in 1692. Huet died in Paris January 26, 1721. His works were published in a collected form in 1712, and a volume of *Huetiana* appeared in 1722. For his life, consult Trochon (Paris, 1877), and his autobiography (trans., London, 1820).

HUFELAND, hōō'fe-länt, CHRISTOPH WILHELM (1762-1836). A German physician, born at Langensalza in Thuringia. He studied medicine at Jena and Göttingen, was professor of medicine at Jena from 1793 to 1798, was physician in ordinary at the Court of Weimar, and resided at Berlin from 1798, where he was professor of therapeutics and pathology from the foundation of the university in 1810. He had a very high reputation for learning and skill as a physician, and he was equally esteemed for his intellectual abilities, and his noble and benevolent character. His published works are numerous, chiefly on medical and physiological subjects. His *Makrobiotik*, or the *Art of Prolonging Life* (1796), was translated into almost all the languages of Europe. Among his most important works are: *Ueber die Ursachen, Erkenntnis und Heilart der Skrofelkrankheit* (1795); *Guter Rath an Mütter über die wichtigsten Punkte der physischen Erziehung der Kinder* (1799); and *Enchiridion Medicum* (1836).

HÜFFER, hụf'fẽr, HERMANN (1830—). A German historian and jurist, born at Münster, and educated at Bonn and Berlin. He was appointed professor of jurisprudence at Bonn in 1860, and in 1884 was made Privy Councilor. From 1867 to 1870 he was a member of the North German Reichstag. Besides his main work, *Diplomatische Verhandlungen aus der französischen Revolution* (1868-79), the following may be mentioned: *Quellen zur Geschichte des Zeitalters der französischen Revolution* (part i., dealing with the years 1799-1800, 1900-91); *Rheinisch-westfälische Zustände zur Zeit der französischen Revolution* (1873); *Der Rastatter Gesandtenmord* (1896); and the literary writings: *Aus dem Leben Heinrich Heines* (1878); *Zu Goethes Campagne in Frankreich* (1883); *Annette von Droste-Hülshoff und ihre Werke* (1887-90); and *A. L. Mencken, der Grossvater des Fürsten von Bismarck* (1800).

HUG, hōōg, Johann Leonhard (1765-1846). A Roman Catholic scholar. He was born at Constance, June 1, 1765, studied at Freiburg, and in 1789 entered into priest's orders. In 1791 he was appointed professor of Oriental languages and of the Old Testament at Freiburg, and in 1792 of the New Testament also. The most important fruit of his biblical researches was his *Introduction to the New Testament* (1808; 4th ed. 1847; Eng. trans., London, 1827, New York, 1830). His great eminence as a biblical scholar led to his being called on to take part in the arrangement of the newly organized studies of several German universities, as at Breslau, in 1811; at Bonn, in 1816; at Tübingen, in 1817; and again at Bonn, 1818, and 1831. He died March 11, 1846. Among his untranslated works are *De Antiquitate Codicis Vaticanæ Commentatio* (1810); *Das hohe Lied* (1813); *De Pentateuchi Versione Alexandrina Commentatio* (1818); *Gutachten über das Leben Jesu, kritisch bearbeitet von D. Fr. Strauss* (1835); and several on subjects of classical criticism, especially an interesting work on the ancient mythologies (1812). Consult A. Maier, *Gedächtnissrede auf Hug* (Freiburg, 1847).

HÜGEL, hụ′gel, Karl Alexander Anselm, Freiherr von (1796-1870). An Austrian soldier, traveler, and naturalist, born at Regensburg. He visited Greece, Crete, and Cyprus, examined the ruins of Palmyra and Baalbek, made numerous journeys through Syria and Palestine, and arrived at Bombay in 1832. Thereupon he traversed the greater part of the Deccan, ascended the Nil-Gherria range, undertook thorough geographical researches in Ceylon, and in 1833 shipped from Madras to Australia (then New Holland). He returned to India (Calcutta) by way of the Philippines, penetrated through Bengal to the Tibetan frontier, and reached Vienna early in 1837. He contributed papers regarding his expedition to Austrian scientific publications and to the *Journal* of the Royal Geographical Society of London, and wrote also: *Kaschmir und das Reich der Siek* (4 vols., 1840-42); *Das Kabulbecken* (2 vols., 1850-52); and *Der Stille Ozean und die spanischen Besitzungen im ostindischen Archipel* (1860). Other scholars, among them Endlicher, Heckel, Fenzl, and Schott, also prepared the results of his scientific collections. He obtained a European reputation as a horticulturist, and founded and became president of the Austrian Horticultural Society.

HUGER, ū-jē′, Benjamin (1805-77). An American soldier, prominent on the Confederate side in the Civil War. He was born in Charleston, S. C.; graduated at West Point in 1825; and served in topographical and ordnance duty until the Mexican War, in which he was chief of ordnance in General Scott's army. For his services he was brevetted successively major, lieutenant-colonel, and colonel. From 1848 until 1860 he commanded various arsenals. Soon after the outbreak of the Civil War he entered the Confederate service as a brigadier-general, and was soon promoted to be a major-general, in which capacity he commanded a division in the Seven Days' Battles against McClellan, but was relieved from his command for his failure to intercept the Federal army after the battle of Malvern Hill. He subsequently served in the ordnance department in the Trans-Mississippi district.

HUGER, Isaac (1742-97). An American soldier in the Revolution, born on Limerick Plantation, S. C., of French Huguenot ancestry. He was sent to France to be educated, and on his return to America served in 1760 as a lieutenant of a volunteer militia company, in a campaign against the Cherokees. With his four brothers, he entered enthusiastically into the revolutionary movement. He served first as colonel in the South Carolina militia organization, and in January, 1779, was commissioned brigadier-general in the Continental Army. He took part in all the campaigns in the South, was especially relied upon by General Greene, to whom he was second in command in his North Carolina campaign against Cornwallis in the early months of 1781, and was wounded at the battle of Guilford Court House.

HUG′GINS, Sir William (1824—). An English astronomer, born in London. He devoted himself to the study of astronomy, and in 1856 built an observatory at his residence in Upper Tulse Hill, London, in which he mounted a telescope of eight-inch aperture, and made careful drawings of Mars, Jupiter, and Saturn. His attention was first engaged in observations on double stars, but afterwards he took up spectrum analysis. His first discovery in this line was presented to the Royal Society in a paper on the "Lines of Some of the Fixed Stars." He found also that some of the nebulæ gave a spectrum of a few bright lines only, which showed that the light had emanated from heated matter in the state of gas; and, further, that one of the principal constituents of the gaseous nebulæ is hydrogen. He concluded, therefore, that the nebulæ are not simply clusters of stars too distant to be separately distinguished, but relics of the mass of glowing gas from which the solar system is supposed to have been formed by condensation. (See Nebulæ.) He has also examined the spectra of comets, and has found that part of the light of these objects is different from the solar light. He also proved the existence of carbon in comets. Huggins was the first to apply Doppler's principle (q.v.) to the measurement of stellar velocities toward the solar system or away from it. This important kind of observation has since been carried on by many astronomers, and promises to throw entirely new light on the constitution of the sidereal universe.

He also made innovations along other lines. He introduced photography into astronomy, which, however, was of limited use till about 1875, when the invention of the gelatin dry plate enabled the astronomer by long exposure to accumulate sufficient amount of light to obtain good pictures of celestial objects, too faint to be seen even with the most powerful telescope. Huggins also invented a spectroscopic method for studying the red prominences of the sun, and proved, through a laboratory experiment, the existence of calcium in the solar prominences and chromosphere. In all his various researches Huggins has been ably assisted by his wife. In recognition of his services to science, a number of honors were bestowed upon Huggins by various scientific bodies. He was president of the Royal Astronomical Society from 1876 to 1878, of the British Association for the Advancement of Science in 1891. He was chosen president of the Royal Society in 1900, and has at different times received the Royal, the Copley, and the Rumford medals. Besides a number of original papers, he published, jointly with Lady Huggins, *An Atlas of Representative Stellar Spectra* (1900), which received the Actonian Prize of the Royal Institution.

HUGH, hū (?-947). King of Provence and Italy. He was the son of Lothair, Count of Arles, and after the death of Louis the Blind (923) became ruler of Provence. In 926 he was crowned King of Italy at Paris, by the subjects of Rudolph, who were in revolt. His attempts to make himself Emperor involved him in constant war. Lombardy was invaded by the Hungarians, and Berengar finally drove him into Provence, where he died.

HUGH, Saint (c.1135-1200). Bishop of Lincoln. He was born at Avalon, near Pontcharra, Burgundy, on the border of Savoy, about 1135. His father was Lord of Avalon, but renounced the world when Hugh was eight years old and took his son with him into a monastery near Grenoble. In 1160 Hugh became a Carthusian monk at the Grand Chartreuse, and won such high repute that he was called in 1175 by Henry II. of England to put in order a monastery of the Order at Witham, Somerset. His great success led to his election as Bishop of Lincoln in 1186. Every year he spent a little time in retreat in Witham Monastery, but the rest of his time he lived the life of a busy and most efficient bishop. His moral courage made him fearless in resisting unjust demands from King or peasant, and a charity which was boundless endeared him to the people. So while he lived he was held in universal esteem, and when he died in London, November 16, 1200, he was not forgotten, and his tomb in Lincoln Cathedral became a place of pilgrimage. Consult his life in Latin edited by Dimock (London, 1864); in English by Perry (ib., 1879); Thurston (ib., 1898); Bramley (1901), in connection with memorial sermons on the 700th anniversary of his death (Lincoln, 1901); and by Charles Marson (London, 1901).

HUGH CAPET, hū kȧ'pĕt, Fr. **HUGUES CAPET,** ụg kȧ'pȧ' (939-96). King of France from 987 to 996. He was a son of Hugh the Great, Count of Paris, and Hedwig, a sister of Otho the Great of Germany. Hugh Capet succeeded his father as Count of Paris in 956, and became thereby the real ruler of the country, though the title of King still belonged to the Carolingians. When, in 987, Louis V., the last Carolingian King of France, died without heirs, Charles, Duke of Lorraine, claimed the throne by descent, but at a meeting of the nobles and prelates of the realm at Senlis it was declared that the crown was elective, and thereupon Hugh was chosen, and became the founder of the Capetian dynasty (q.v.). Charles of Lorraine was easily defeated in the contest which ensued. The rest of Hugh's life was passed in a kind of border warfare against the great feudatories whose territories surrounded the royal domain. In 988 he had his son Robert elected and crowned as his successor.

HUGHENDEN, hū'*en*-den (*Hitchendon*). A parish of Buckinghamshire, England, among the Chiltern Hills, north of High Wycombe (Map: England, F 5). It is noted for Hughenden Manor, long the residence of Benjamin Disraeli, Earl of Beaconsfield. Earl and Lady Beaconsfield are buried in the parish church, which contains a monument erected by Queen Victoria to the statesman's memory. Population, 1800.

HUGHES, hūz, Ball (1806-68). An American sculptor. He was born in London, studied seven years with Edward H. Bailey, and won several important prizes at the Royal Academy. He also executed a bust and a statuette of George IV. In 1829 he came to New York and made a marble statue of Alexander Hamilton for the Merchants' Exchange. It was destroyed in the fire of 1835. He also made the high relief of Bishop Hobart, now in Trinity Church, New York City. Among his later works are a bronze statue of Dr. Nathaniel Bowditch, in Mount Auburn Cemetery, near Boston, a statuette of Gen. Joseph Warren, a bust of Washington Irving, and a model for an equestrian statue of Washington.

HUGHES, David Edward (1831-1900). An English-American inventor. He was born in London, but was early brought by his parents to the United States, where he subsequently received his education at Bardstown College, Kentucky. In 1850 he was made professor of music, and later of natural philosophy at that college. In 1855 he took out a patent for his first important invention—the printing telegraph, which bears his name. After his telegraph was adopted in the United States, he went to Europe (1857), where the instrument was successively adopted by France, Italy, England, Russia, Germany, Austria, Turkey, Holland, Belgium, Switzerland, and Spain. Among his other inventions and discoveries may be mentioned the microphone (1878) and the induction balance (1879). In recognition of the great value of his services to commerce and the arts, medals and numerous titles of honor were bestowed upon him by various scientific bodies, and by the governments of nearly all the European States. His publications comprise a number of papers on electricity and magnetism, presented to the Royal Society (of which he was a fellow), and to other societies.

HUGHES, Hugh Price (1847-1902). A British minister of the Wesleyan Church. He was born at Carmarthen, South Wales, and was educated at University College, London, and the theological school in Richmond, Surrey. Obliged by the laws of his Church to move every three years, he left the charge he had taken at Dover in 1869 for Brighton, and was afterwards at Oxford, and in three different London churches before he became stationary in the metropolis as superintendent of the West London Mission and editor of the *Methodist Times* (1885). He refused to accept from the mission a salary greater than $1500, and during the last year of his life, having received a small legacy, served gratuitously. His publications include: *Social Christianity* (1889); *The Atheist Shoemaker* (1889); *The Philanthropy of God* (1890); and *Ethical Christianity* (1892). Consult *Hugh Price Hughes as We Knew Him* (London, 1902).

HUGHES, John (1797-1864). An American prelate, first Archbishop of New York; born in Annaloghan, County Tyrone, Ireland. Brought up in the northern or Protestant section of his native land, where Orange societies were rife, he early became imbued with the combative spirit which ever afterwards characterized him. His parents were poor, and could give him little schooling, but he educated himself, and at the age of twenty emigrated to the United States, where he worked as a day laborer in Maryland and Pennsylvania for three years, until he gained admission to the Roman Catholic College of Mount Saint Mary, Emmitsburg, Md. There he earned distinction as a debater and also as a collector of funds for the rebuilding of the college after it was burned down. He was ordained a priest in 1826, and the same year the first of his controversial pamphlets was published, *An Answer to Nine Objections Made by an Anonymous Writer Against the Catholic Religion.* After being assistant at the Church of Saint Augustine, Philadelphia, he went to Bedford, Pa., thence returned to Philadelphia (1827), to take charge of Saint Joseph's Church, afterwards took charge of Saint Mary's, and was the founder of Saint John's Orphan Asylum (1829). From 1833 to 1835 he published in the *Catholic Herald* his replies to his Presbyterian antagonist, Dr. Breckenridge. In 1838 he was appointed coadjutor of the Bishop of New York, four years afterwards became a bishop himself, and continued his controversies upon educational, political, and religious affairs, in which his oratorical powers exerted a potent influence. One of Bishop Hughes's first undertakings was the establishment of a short-lived theological seminary at Lafargeville, Jefferson County, which was reopened at Fordham under the name of Saint John's College in 1841. In 1850 he was made an archbishop, and in 1861 was sent on a special embassy to gain the friendship of France for the North in the Civil War, extending his influence in the same cause both to Ireland and Italy. Two volumes of his writings, edited by Lawrence Kehoe, were published in 1865 after his death. Consult: Hassard, *Life of John Hughes* (New York, 1866); and Brann, *John Hughes* (New York, 1892), in the "Makers of America Series."

HUGHES, Thomas (1823-96). An English author and politician, second son of John Hughes, of Donington Priory, Newbury, Berkshire, born at Uffington, Berks. He was educated at Rugby under the celebrated Dr. Arnold; graduated B.A. from Oriel College, Oxford, in 1845; was called to the bar at Lincoln's Inn in 1848, and became a member of the chancery bar. In 1856 he gave to the world *Tom Brown's School Days*—a picture of life at a public school, evidently written from the author's own personal experience, and recording the vivid and enduring impressions he brought with him from Rugby. It was followed, in 1858, by *The Scouring of the White Horse;* in 1861, by *Tom Brown at Oxford*, in which the mental history of his hero is continued, with sketches of college life and incidents; and in 1869, by *Alfred the Great.* Hughes pursued meanwhile the study and practice of the law; and was appointed Queen's Counsel in 1869. He gained the confidence and good-will of the working classes by endeavoring to promote a better understanding between masters and men, and by teaching the latter the value of coöperation as a means of social elevation. At the general election for Lambeth in 1865, he was placed at the head of the poll, the workingmen being especially enthusiastic in securing his return. In 1868 he was returned for Frome, which he continued to represent till 1874, and always took a prominent part in debates relating to the combinations of trades-unions, and the amendment of the law of master and servant. In 1880 he took a leading part in the socialistic settlement at Rugby, Tenn. Hughes also wrote: *Memoir of a Brother* (1873); *Vacation Rambles* (1895); and several other works.

HUGH OF LINCOLN, liŋ′kon. A boy who is the hero of a mediæval legend. The story is told variously in the chronicles and ballads. According to one version, twenty-four boys were playing ball. Sir Hugh of Lincoln, who kicked the ball through the window of a Jew, was enticed into the castle by the Jew's daughter, murdered, and thrown into a well, from which he addressed his mother miraculously, and thus disclosed the crime. The story, based upon the belief that the Jews murdered Christian children, is found throughout the popular literature of mediæval Europe. It received the highest artistic treatment in Chaucer's *Prioress's Tale.* Consult Child, *English and Scottish Popular Ballads*, part v. (Boston, 1888).

HUGH OF LUSIGNAN, lụ′zē′nyäɴ′. The name of several counts of La Marche, of whom the best known is Hugh X. (1208-49). During his father's life King John of England had robbed him of his bride, Isabella of Angoulême. After John's death he married Isabella, who styled herself countess-queen. He participated in the crusade against Damietta (1219). During the minority of Louis IX. he was one of the leading nobles who revolted against the regent, Blanche of Castile, but was compelled to submit. In 1241 he insulted his overlord, the brother of Saint Louis. The latter subdued him, but pardoned him.

HUGH THE GREAT (?-956). Count of Paris (called also The White). On the death in 923 of his father, Robert I., who had been elected King of France in opposition to Charles the Simple, he could have taken the title of King, but instead permitted it to go to his brother-in-law, Rudolph of Burgundy. He took the same course after the death, in 936, of Rudolph, who was succeeded by Louis d'Outre Mer, a young son of Charles the Simple. Meanwhile Hugh had amassed large estates, and as Louis proved anything but a docile King, Hugh was forced to seek the assistance of his brother-in-law, Otho the Great of Germany, in the war that ensued. The King was captured and released, after giving up to his conqueror the city of Laon. Louis immediately renewed the struggle, and this time was victorious. Peace was proclaimed in 950. Four years afterwards Hugh again had the opportunity to make himself King, on Louis's death (954), but he favored the election of Lothair, and in reward for his services was invested with the duchies of Aquitaine and Burgundy. It was his son, Hugh Capet, who ascended the throne thirty years later.

HUGH THE GREAT (1057-1101). Count of Vermandois, the third son of Henry I. of France. He joined the First Crusade (1096), and was taken prisoner. Rescued by Godfrey de Bouillon, he continued to fight in the Holy Land, and died there from the effects of a wound received near Nicæa. There seems to have been no reason for his being called 'The Great,' except that that was the customary sobriquet among the Capetians.

HUGLI, or **HOOGLY,** hōōg'lĭ. The westernmost and principal deltaic channel of the Ganges, British India, formed by the junction of three offsets of the Ganges, the Bhagirathi, the Jalangi, and the Churni, known as the Nadiya rivers (Map: India, E 4). It is 125 miles long, the estuary, as far as Saugor Roads, measuring 35 miles more. It is the most available for navigation of all the channels by which the Ganges reaches the sea. In the dry season the tide is felt as high as Chandernagar, 17 miles above Calcutta. During the southwest monsoon the Hugli is subject to a bore seven feet high, often ascending at the rate of 22 miles an hour. Ships drawing 26 feet of water can ascend to the port of Calcutta. The entrance of the river is much incumbered with shoals, and dredgers are constantly employed in maintaining a clear channel.

HUGLI, or **HOOGLY.** A city and river port of Bengal, British India, capital of a district of the same name, on the right or western bank of the river Hugli, 27 miles north of Calcutta, in latitude 22° 54′ N., and longitude 88° 22′ E., on the Calcutta and Allahabad Railway. The city was founded by the Portuguese in 1547. Chinsura (q.v.), which now forms a part of it, was founded by the Dutch. It contains several important educational institutions, including the Hugli College, and is also the seat of an extensive military cantonment. Population, in 1891, 33,060; in 1901, 29,383.

HUGO, hōō'gō, GUSTAV VON (1764-1844). A German jurist, born at Lörrach, Baden, and educated at Göttingen. After acting as tutor to the Prince of Anhalt-Dessau (1786), he became professor of law at Göttingen (1788). In 1819 he was made Privy Councilor. He made important investigations of the sources of Roman law. He was, together with Savigny and Haubold, one of the founders of the historical method in jurisprudence. He edited: *Ulpiani Fragmenta* (1788); translated Gibbon's chapter on Roman law as *Uebersicht des römischen Rechts* (1789); *Pauli Sententiæ Receptæ* (1796); and *Jus Civile Ante-Justinianum* (1815). But his most important labor was his own book, *Lehrbuch eines civilistischen Kursus* (1792), and his *Civilistisches Magazin* (1814-37), with its supplement, *Beiträge zur civilistischen Bücherkenntnis der letzten vierzig Jahre* (1828-45). Consult Eyssenhardt, *Zur Erinnerung an Gustav Hugo* (Berlin, 1845).

HUGO, ụ'gō', VICTOR MARIE (1802-85). The greatest French poet of his century, a distinguished dramatist, novelist, essayist, and politician. His first volume appeared in 1822. For nearly two-thirds of the century he was a leader in French literature, for the greater part of that time preëminently the leader. He represents the supreme reach of an individualistic and romantic movement. Besançon, his birthplace, had once been a Spanish city—a significant fact, for his work often shows Spanish influence. His father was a distinguished officer of the Republic and Empire, his mother the daughter of a sea captain of Nantes, of royalist and Catholic sympathies. With her the child lived in Paris till 1811, when General Hugo summoned his family to join him in Madrid, whence he was constrained to send them back in 1812, as King Joseph's cause was growing desperate. The impressions of this year left deep marks on many of Victor's works, notably *Bug Jargal*, *Hernani*, *Ruy Blas*, and *Torquemada*. Afterwards, until the fall of the Empire, he was once more with his mother in Paris in the abandoned Convent of Les Feuillantines, which appears prominently in *Les Misérables*. Set at technological studies by his father, he aspired at fourteen 'to be Chateaubriand or nothing,' wrote a Miltonic *Deluge*, and planned dramas, epics, and operas. At fifteen he competed for an Academic prize, winning honorable mention and some minor literary patronage. Two years later (1819) he won three prizes at the poetic competition (*Jeux Floraux*) of Toulouse. He also wrote at this time, though he did not publish it in this form till his old age, a novel, *Bug Jargal*, a story of Haiti, of great promise and weird power. An extended revision of this was printed in 1826. In 1819 he founded a fortnightly literary journal, *Le Conservateur Littéraire*, the failure of which, with the withdrawal of his allowance from his father, reduced him to a poverty that gave materials for the Marius episodes in *Les Misérables*. His brother, Abel, generously helped him to print *Odes et poésies diverses* (1822), which paid him 700 francs, and caused King Louis XVIII. to grant him a pension of 1500 francs, increased later to 3000. On the strength of this he married (October, 1822), and thereafter enjoyed a happy domestic life. These verses, in their brilliant rhetoric and richness of rhythmic melody, had been approached in that generation only by Lamartine's *Méditations*. They show an ardent royalism, a perfunctory and sonorous religiosity, and an intense political passion, on which Napoleon was already beginning to exercise a fascination that declared itself openly in the superb *Ode on the Vendôme Column* (1827).

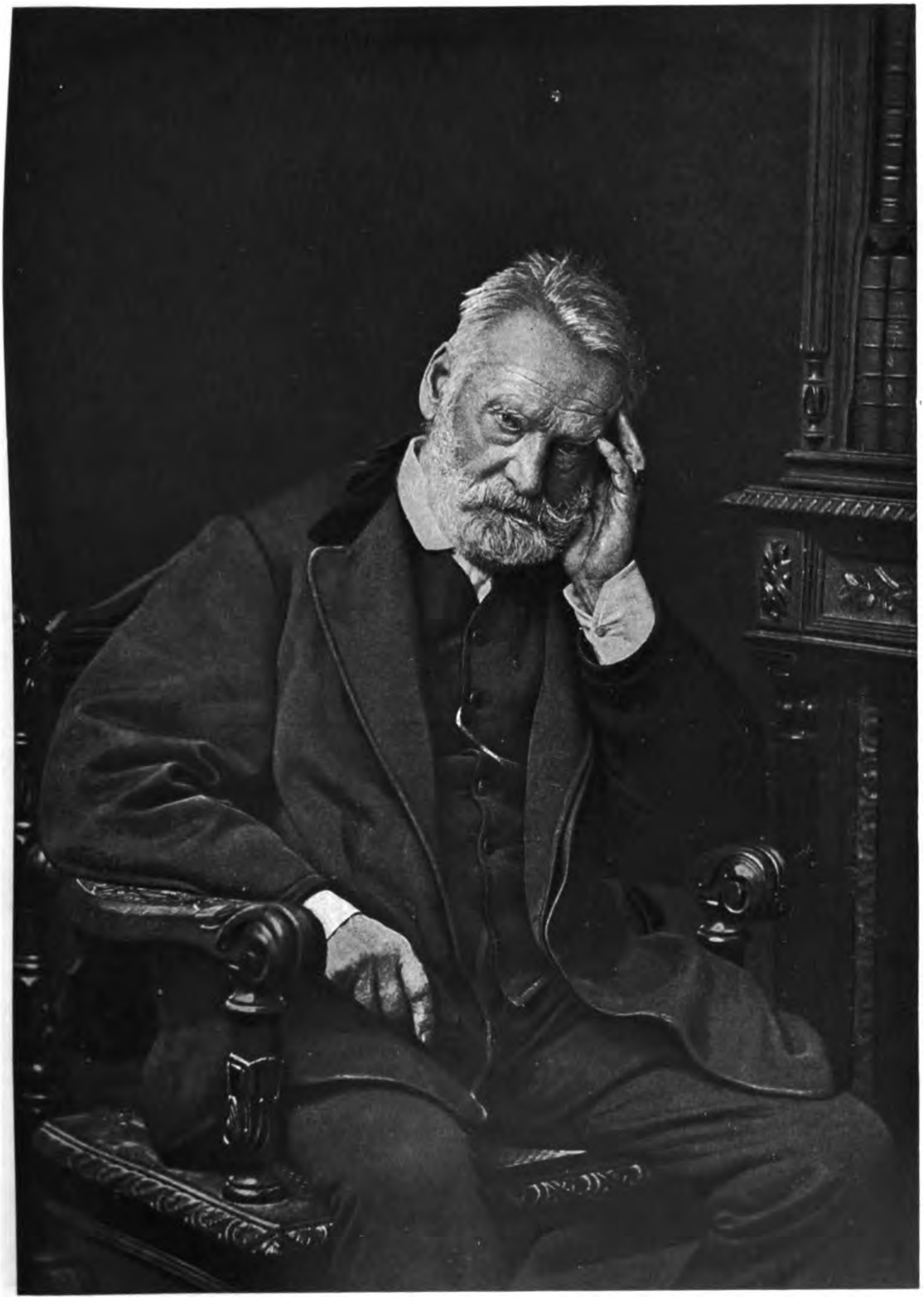
The next few years were occupied with an extravagantly romantic novel, *Han d'Islande* (1823), and with literary journalism. In 1826 appeared *Nouvelles odes et ballades*, whose preface was a sort of literary manifesto of Romanticism, and of the first *Cénacle* (q.v.). Versification and rhythm here begin to show an aggressive individuality, and several poems indicate that sympathetic study of the mediæval mind which is associated with French Romanticism. Hugo was recognized as the Romantic leader, and asserted and confirmed that position by *Cromwell* (1827). As early as 1826 the Odéon Theatre had offered hospitality to an English company, in which were Charles Kemble and Miss Smithson. This company played *Othello*, *Romeo and Juliet*, and *Hamlet*, all of which were enthusiastically greeted by the new French school. Indeed, Kemble and his companions did not leave the Odéon till July, 1828. *Cromwell* begins with an elaborate preface full of dramaturgic observations, more opportune than new; but they now became the rallying-point of a school who thought "the drama the only complete poetry of our time, the only poetry with a national character." This school demanded for the drama an unconventional vocabulary and a mingling of tragic and comic, to show more fully the irony of destiny, thus unconsciously following Diderot (q.v.), while attempting to follow nature. In all Hugo's dramas the lyric element tends to delay the dramatic effect. *Hernani* and *Ruy Blas* alone are still played in France.

Cromwell was followed by a drama taken from

Scott's *Kenilworth—Amy Robsart* (1829), a failure—and *Marion Delorme,* which the censorship forbade the stage till 1831. In 1829 Hugo published *Les Orientales,* a collection of poems containing some of the most striking pieces of metrical art in the world. They were followed by the long-contested triumph of *Hernani* and of Romanticism on the French stage (1830), after Hugo had vainly tried to bring about the performance of *Marion Delorme.* For nearly a hundred days, from February 26th to June 5th, the battle raged nightly at the Théâtre Français, but no further organized effort was made to resist the retrograde evolution of the Romantic drama till it collapsed with Hugo's *Les Burgraves* in 1843. The situation in *Hernani* is strained and dramatically unreal, the sentiment is mawkish, the oratory grandiloquent; but a throbbing life and intensely expressed emotion maintain the interest, though this is a lyric rather than a dramatic one. The same qualities and the same defects, with more strained antithesis of grotesque and sublime, tragic and comic, foul and fair, characterize *Marion Delorme* (1830). They characterize also *Le roi s'amuse* (1832); the prose dramas, *Lucrèce Borgia* (1833); *Marie Tudor* (1833); *Angelo, tyran de Pedoue* (1835). They reach their height in *Ruy Blas* (1838), and become most conspicuous in *Les Burgraves* (1843). Hugo's conceptions were too grandiose to be reconcilable with the limitations of the drama. He gave up the effort and turned to politics. But these sixteen mainly dramatic years had produced work of great value in other fields, the novel *Notre-Dame de Paris* (1831), with its Gothic intensity of pathos and its marvelous reproduction of the Paris of Louis XI.; the Quixotic but eloquent *Claude Gueux* (1834), a plea against capital punishment; the *Feuilles d'automne* (1831); *Chants du crépuscule* (1835); *Voix intérieures* (1837); *Les rayons et les ombres* (1840); four collections of poems that show growing democratic sympathies and satiric power, a deepening communion with nature, and a generous warmth of universal sympathy, a little shallow in its breadth, that was to give the keynote to his political activity of the next decade.

The ten years from 1843 to 1853, from *Les Burgraves* to *Les châtiments,* count no literary work of import, but they mark a vital change in the mind of Hugo that affects all the work to follow. Till 1843 drama had taken the first place. From 1853 fiction becomes more prominent, poetry intermittent, with occasional political writings. Hugo sees that his power is essentially lyric, and gives this a dominant place even in prose fiction. Through all there is a new earnestness, born in part of the death of his daughter, Leopoldine, and her young husband (1843), in part of a vague yet intense enthusiasm for the socialistic ideas of Fourier and Proudhon which drew him into a political whirlpool and made him a revolutionary member of the Constituent Assembly of 1848. As a practical politician, then and always, Hugo was a failure. He favored the ambition of Louis Napoleon, till Louis ceased to favor his own advancement; he was an advocate of several hopelessly unpractical schemes, and an unconscious convert to the caressing flattery of Emile de Girardin. Napoleon's coup d'état of 1851 saved Hugo from himself. It made a martyr and hero out of a visionary who was distrusted as a turncoat. In his eloquent *Histoire d'un crime* (finished in 1852 and published in 1877), he shows unconsciously how his efforts to organize resistance to the usurper were distrusted by his fellow Republicans. He fled to Brussels, whence he was urgently requested to move on to England, and resided first in Jersey, then in Guernsey, as near France as possible, consistently scorning every offer of amnesty till the collapse of the Second Empire brought him back to share the darkest days of the Terrible Year (1870-71).

These years of exile steeled his mind, and his genius was fired by what seemed his country's shame. In 1852 appeared the fierce and scurrilous *Napoléon le Petit,* a foretaste of the *Les châtiments* (1853) in which the satiric unites with the lyric genius to produce a classic that will survive for generations the Empire that fired Hugo to a white heat. To calmer hours we owe *Les contemplations* (1856), a collection of lyrics closing in a noble strain, and the first of four volumes of *La légende des siècles* (1859, 1877, 1883), the high-water mark of his achievement in lyrical epic. In 1862 the long-heralded *Les Misérables* appeared on the same day in ten languages—an event till then unparalleled in the annals of letters. The ten volumes of this vast romance reveal Hugo, no longer as in *Notre-Dame,* an evoker of the past, but with eyes on the present and heart in the future. It lacks continuity and proportion. It is a chaos of eloquent special pleading, political reminiscences, socialistic prophecies, bad psychology, grotesque situations, false pathos, and descriptions wonderfully vivid and absorbing. In the hurly-burly of this lyric-epic novel we find most of the virtues and all the intellectual vices of Hugo. Its value lies not in its thought, but in its emotion, its lyric cry, and its epic power of description. On the development of fiction it had no influence, for it belonged to a type already outworn. The same may be said of *Les travailleurs de la mer* (1866), in which the descriptions are superb, and the subject petty. *L'homme qui rit* (1869), an historical phantasmagoria of the English Court of Elizabeth and an unmitigated failure, closes the fiction of the exile. Meanwhile Hugo's poetic muse had had her Indian summer in *Chansons des rues et des bois* (1865). But as the Empire tottered to its fall, his inauspicious interest in politics became once more dominant. He wrote much for *Le Rappel,* a radical journal, founded by his sons and son-in-law, but revealed once more, in 1870, the hopelessly unpractical nature of his political ideas, alike as a prophet of the people and as a member of the National Assembly at Bordeaux in 1871. He resigned his seat in March and went to Brussels, where he barely escaped being mobbed, owing to his defense of the Paris Commune. He was expelled from Belgium, and soon after returned to Paris. Here he failed signally in the elections of 1872, though he was elected life Senator in 1876. But if he might not be a tribune, he was already the poet laureate of the Third Republic. Of the *Les châtiments* 100,000 copies were sold within a year, several plays, notably *Ruy Blas,* were revived with success, and he rose to the new occasion in *L'année terrible* (1872), a noble volume of patriotic verse that made a French critic exclaim, with just pride, that Germany had no such poet to sing her victory as France to glorify even her disaster.



VICTOR HUGO
FROM A PHOTOGRAPH

Hugo was now past seventy, but it is too early to speak of his decline. He could pose as old, indeed, in the poems of *L'art d'être grandpère* (1877); but *Quatre-vingt-treize* (1874) is the most virile of his novels, with more intensity of action and a truer tragic catastrophe than *Notre-Dame* or *Les Misérables*, though by no means without their faults and its own. The second part of *La légende des siècles*, if inferior to the first, is still grand; there are passages of primary quality in *Les quatre vents de l'esprit* (1881), *La pitié suprême*, and even in the *Philosophic Poems* (*Le pape, Religions et religion, L'âne*, 1878-80); the drama *Torquemada* (1882) is vigorous at least by starts, and in the posthumous volumes (*Le théâtre en liberté, La fin de Satan, Toute la lyre*) one comes constantly on verses that bear his unmistakable mint-stamp.

He died in Paris, May 22, 1885. His great age, reaching out into a new generation from an epoch that had passed away, and was indeed more foreign to that day than to our own, could not but impress popular imagination, the more so as his talent, his manner, and his personal physique had something of the monumental and grandiose. Thus his death stirred an unparalleled wave of popular feeling. His body lay in state beneath the Arc de Triomphe. His funeral became a pageant that royalty might envy, and could not equal. The relics of Saint Geneviève, the patron saint of Paris, were removed from the Pantheon that it might receive the popular hero.

Despite his own belief, Victor Hugo had no new or deep theories of life. He was the confidant of his century, "the sonorous echo in the middle of things." Personally he was vain, and rather ignorant, if we compare his knowledge with his pretensions. But he is Olympian in his defects—Zeus, Apollo, and Hephæstus turned into one. His convictions are not important. He thinks to proclaim an oracle and reiterates a commonplace. But he is perhaps the greatest compeller and gatherer of words, the greatest master of language that we know; a great writer, rather than a great author, and therefore the more sure of an enduring democratic fame. He has formed the rhetorical and poetic taste of three generations of French youth. All schools of French verse that have arisen in the last half-century have united to call him their father.

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HUGO OF FLAVIGNY, flȧ'vē'nyē' (1064-?). A Franco-German monk and scholar, born in Verdunois. He was educated in the Monastery of Saint Vannes, and afterwards went to Dijon, where, about 1090, he began his *Chronicle*. In 1095 he went to England, and a year afterwards became Abbot of Flavigny. He was obliged to leave his abbey in 1099, and though reinstated in 1100, was again forced to leave it by the hostility of Norgaud, Bishop of Autun, and retired to Dijon. His *Chronicle* is of value for its account of the last years of the eleventh century, and extends from the birth of Christ to 1102. The original manuscript was in the possession of the late Sir Thomas Phillipps, the antiquary, and was one of the great Meerman collection, before he bought it. It was published by P. Labbe in *Bibliotheca Manuscriptorum Nova*, and in the *Monumenta Germaniæ Historica*.

HUGO OF SAINT VICTOR (c.1097-1141). A French monk and theologian, born probably in Lorraine. He was educated in the Monastery of Hamersleben in Saxony, and became monk in the Abbey of Saint Victor, near Paris. Until the middle of the thirteenth century his works were very popular. In his treatment of most of the general questions of theology he kept to the beaten path, but his views on psychological questions were original. There has been much discussion as to the authenticity of certain writings attributed to him. In *Les œuvres de Hugues de Saint Victor* (1886) M. Hauréau gives a list of those about which there seems little doubt, and disregards many theretofore considered his. Hugo's most famous book is *De Sacramentis Christianæ Fidei*. An excellent edition of his works was published at Venice in 1588.

HUGUENOTS, hū'gē-nŏts, *Fr. pron.* ụg'nō' (derivation unknown, possibly corrupted through *Ignots, Iguenots*, from Ger. *Eidgenossen*, confederates; according to others, a diminutive of *Hugo, Hugues*, Hugh). The name borne by the Protestants of France from about the year 1560 till their extinction as a political party in the seventeenth century; in a more general sense, the adherents of the Reformed religion before the French Revolution. Lutheran Protestantism invaded France as early, probably, as 1520, and its principles were warmly embraced by large numbers of the learned classes and the nobility. The followers of the new religion enjoyed the special protection of Margaret of Angoulême, Queen of Navarre and sister of Francis I. The work of John Calvin (q.v.), himself a Frenchman, gave energy and cohesion to French Protestantism; but its strength always remained in the nobility and the middle classes, and it never appealed to the masses of the people as in Northern Germany.

Toward the end of his reign Francis I. opposed the Huguenots with great severity, and caused many to be burned. During the reign of Henry II. the persecution assumed a still severer character, the *Chambre Ardente* (q.v.) being erected in 1547 for the trial of heretics. Nevertheless the Protestants increased in numbers, and strengthened their organization. The first national synod on May 23, 1559, adopted a Calvinistic code of eighty articles which became the constitution of French Protestantism. The influence of the Guise family, who began to come into power in the reign of Francis I., now showed itself in bitter warfare upon the Huguenots, whose cause was supported by the powerful Bourbon family, the great rivals of the Guises. In 1560 the extremists among the Huguenots, headed by La Rénaudie, a nobleman of Périgord, conceived the plan of seizing the person of the young King, Francis II., and placing him under the guardianship of the Bourbon princes. The plot, however, known as the conspiracy of Amboise, was betrayed, the King was made secure in the castle of Amboise, and the Duke of Guise was appointed Governor-General. Numerous executions and reprisals followed, and Condé was imprisoned. The Edict of Romorantin, in May, 1560, took the prosecution of heretics out of the hands of the Parlements and put it into those of the bishops. By the Assembly of Notables in August, it was resolved that the whole matter of religion should rest until the next assembly of the States-General. Francis II. died on December 5, 1560, and Charles IX., a boy of ten, ascended the throne. The Queen-mother, Catharine de' Medici (q.v.), being determined to take the power into her own hands, was compelled to seek Huguenot support against the Guises. In July, 1561, appeared an edict which freed dissenters from the penalty of death. For the complete termination of strife, the Court caused a religious conference to be held at Poissy in September, 1561, between the representatives of the two religious parties. The chief disputants were the Cardinal of Lorraine on the one side, and Theodore Beza (q.v.) on the other. The effect of the discussion was merely to widen the breach between the Catholics and the adherents of the new confession, but it served to unite and embolden the Huguenots, with whom the machinations of the Guises forced Catharine into closer alliance. On January 17, 1562, appeared an edict, giving noblemen the right of the free exercise of their religion on their own estates. This was followed by the recourse to arms on the part of the Guise faction.

Violence and reprisals were perpetrated on both sides. On March 1, 1562, a company of Protestants meeting in a barn at Vassy for religious exercises, was attacked, and many of them were massacred by the followers of the Duke of Guise. Condé raised the Protestant standard at Orleans, while the Guises seized the person of the King and proclaimed the Huguenots rebels. This was the beginning of the First Civil War. The Huguenots were at first successful, overran the southwestern part of the country, and were joined by 4000 soldiers from Germany. At Dreux, however, December 19, 1562, the Protestants were defeated. The Duke of Guise was assassinated before Orleans in February, 1563, and on March 19th the Queen-mother concluded the Peace of Amboise, which granted a large measure of religious freedom to the nobles, but set aside one town only in every bailiwick as a place of worship for the Huguenots. The terms of the treaty were disadvantageous when compared with the provisions of the edict of January, 1562, and were accepted by Condé against the vehement remonstrances of Coligny (q.v.). Catharine hated the new faith, and formed a close alliance with the Spaniards for the extirpation of heresy, retrenched the privileges of the Protestants, and made attempts upon the liberty and life of Condé and of Admiral Coligny. These leaders then determined to take possession of the King's person in September, 1567. The Court took refuge in Paris, which Condé invested; on November 10, 1567, an indecisive battle was fought at Saint-Denis between Condé and a much superior force under the Constable Montmorency (q.v.), and soon after Condé fell back into Lorraine, where he effected a junction with an auxiliary force of 10,000 men from Germany, and again threatened Paris; upon which Catharine determined to conclude peace, and the Second Civil War was terminated by the Treaty of Longjumeau on March 23, 1568, which confirmed the terms of the Treaty of Amboise. Catharine, however, had consented to the treaty only to gain time, and had no intention of acting up to its terms. Plots were formed against the lives of Condé and Coligny, who fled to La Rochelle, where they were joined by Jeanne d'Albret, Queen of Navarre, and her young son Henry. With reënforcements from Germany and England, the Huguenots began the Third Civil War, but at Jarnac, March 13, 1569, they were defeated by the royal troops under the nominal command of the Duke of Anjou, afterwards Henry III., and Condé was slain after he had rendered himself prisoner. These misfortunes greatly dispirited the Protestants. Jeanne d'Albret endeavored to reanimate them in an assembly at Cognac, and set up her son, then but fifteen years of age, as the head of the Protestant cause. Coligny became their military leader, and having received a further accession of troops from Germany, laid siege to Poitiers, but was again defeated by the Duke of Anjou at Moncontour, October 3d. Fresh reënforcements from England, Switzerland, and Germany enabled Coligny to take Nîmes in 1569, and to relieve La Rochelle, while La Noue obtained a victory over the royal troops at Luçon. Catharine and her son now sought for peace, to which the Protestants, weary of the hard contest, consented. The treaty, concluded at Saint-Germain-en-Laye on August 8, 1570, gave to the Protestants the free exercise of their religion everywhere except in Paris, and the possession of a number of strongholds.

Catharine, having failed to overthrow the Protestant cause in the open field, sought to accomplish her object by treachery. She entered into friendly relations with the Huguenots, partly, it is true, out of fear of the Guise family. After September, 1571, Admiral Coligny exercised great influence at Court, and was received with much show of affection by the young King and the Queen-mother. The marriage of Henry of Navarre, who had just succeeded his mother in his little kingdom, to Margaret of Valois, sister of Charles IX., seemed to promise an end to the period of civil strife. Then came the massacre of Saint Bartholomew's Day, August 24, 1572, when two thousand Huguenots, among them Coligny, perished. So far from effecting its intended purpose, this detestable deed only roused the Huguenots to take up arms again. The Duke of Anjou lost his army before La Rochelle, and on June 24, 1573, concluded a peace at that place by which the Protestants obtained complete freedom in the exercise of their religion in the three towns of Montauban, Nîmes, and La Rochelle, which were exempted also from the obligation of receiving a royal garrison. Everywhere else the Huguenots were promised freedom from molestation on condition that they should not hold assemblies of more than three persons at a time. A section of the Roman Catholic nobility, at whose head was the Duke of Alençon, the youngest son of Catharine, from purely political motives, united with the Huguenots, and their cause was strengthened by the support of the Politiques (q.v.), the party of compromise and peace. The accession of Henry III., in 1574, was followed by the outbreak of the Fifth Civil War. Henry of Navarre, who, since Saint Bartholomew's Day, had remained a virtual prisoner at the French Court, succeeded in making his escape in February, 1576, and, placing himself at the head of the Huguenot forces in the south, achieved a number of successes in Guienne. This led to the conclusion of the Treaty of Beaulieu, May 6, 1576, by which the Huguenots were granted an increased number of places of security and partial representation in the Provincial Parlements. This was regarded by the Catholics as a surrender to heretics and traitors who had not hesitated to call in foreign aid against their sovereign. The Duke of Alençon was won back to the support of the Court, and under the auspices of Henry, Duke of Guise, the Catholic League was organized for the defense of the Church, the extirpation of heresy, and the maintenance of the honor and authority of the King. Although there were certain ulterior motives which made the League dangerous to the House of Valois, Henry III. for the time put himself at the head of the movement, and at the close of 1576 assembled the States-General at Blois. The severe measures enacted by this body against the Huguenots kindled the Sixth Civil War (1577), which was marked by no important engagement. Peace was concluded at Bergerac on September 17, 1577, and confirmed by the Edict of Poitiers, which guaranteed the preservation of the *status quo*. The Seventh Civil War (the Guerre des Amoureux) broke out in November, 1579, with little cause, and was terminated by the Peace of Fleix in November, 1580, with little result.

There was now a comparatively long interval of repose till 1584, when, by the death of the Duke of Anjou (formerly Alençon), Henry of Navarre became heir to the throne of France. Hereupon, Henry, Duke of Guise, exerted himself for the revival of the League, entered into an alliance with Spain and the Pope for the extirpation of heresy, declared the Cardinal of Bourbon heir to the throne, and began hostilities against the Huguenots. The results of twenty-five years of warfare were destroyed by the Edict of Nemours (July 7, 1585), which annulled all previous edicts of toleration. This was followed by the outbreak of the Eighth Civil War, known as the War of the Three Henrys (Henry III. of France, Henry of Navarre, Henry of Guise). The Catholic League and the King put no less than seven armies into the field, while the Huguenots received large reënforcements from Germany. At Coutras, October 20, 1587, Henry of Navarre defeated the Catholic Army, but this was offset by the victory of Guise over the German auxiliaries at Vimory and Auneau. So contemptible had Henry III. become in the eyes of the people of Paris, that the entrance of the victorious Duke of Guise into the city on May 9, 1588, was followed by an insurrection in his favor. While the Duke was negotiating with the Queen-mother, Henry III. fled from Paris, but at Rouen in July, 1588, acceded to all the demands made by Guise, the extermination of heresy in the kingdom, the convocation of the States-General, and the appointment of Guise to the post of lieutenant-general of France. At Blois, on December 23, 1588, Henry III. caused the Duke of Guise to be murdered, and summoned to his aid Henry of Navarre. In less than a year the King himself was assassinated by Jacques Clément, and Henry of Navarre succeeded to the throne. The League, however, now under the leadership of the Duke of Mayenne, the brother of Henry of Guise, set up the Cardinal of Bourbon as a rival King, and, with the aid of Spanish troops, held its own in Paris. On July 25, 1593, Henry of Navarre formally embraced Catholicism, and in the following year gained possession of the capital. The civil wars in France were brought to an end by the Peace of Vervins between Henry and the Spanish King, May 2, 1598. On April 13th of the same year, the King, in the Edict of Nantes, guaranteed the Huguenots full liberty of conscience and the preservation of their religious and civil condition. See HENRY IV.

Though Henry IV., convinced that the French were a Catholic people and would never accept a Protestant sovereign, abjured his faith on political grounds, his reign was one of broad toleration, and his great Minister, Sully, was a Huguenot. But when, during the minority of Louis XIII., Maria de' Medici, the Queen of Henry IV., assumed the reins of government, the many privileges enjoyed by the Huguenots were found to have created a strong party that stood in the way of absolutism. The King took an oath in 1614 to maintain the Edict of Nantes, but the marriage treaties with the Spanish Court excited the apprehensions of the Huguenots to such a degree that, in November, 1615, they made common cause with the Prince of Condé, who had set up the standard of rebellion. This was contrary to the advice of the most sagacious of their own party. Although by the Treaty of Loudun, May 4, 1616, they obtained a new confirmation of their freedom of worship, the Court now only waited for an opportunity of breaking at least their political power. In June, 1617, a royal edict commanded the entire suppression at once of the Protestant Church and of political privileges, in the Province of Béarn; but the Provincial Court at Pau refused to register the edict, and the matter lay over until 1620, when, urged by his adviser that the time was opportune to strike decisively, the King carried the edict into full effect by force of arms. The Protestants throughout all France took alarm, and hostilities again broke out in May, 1621. At the head of the Protestants were the two brothers, the Duke of Rohan and the Prince of Soubise. Their cause, however, was feebly maintained; almost all the Protestant towns fell into the hands of the King, force, stratagem, and bribery being equally employed. By the Treaty of Montpellier, October 19, 1622, the Huguenots lost a number of their strongholds and the right of assembly without permission of the King. The Court, however, paid little attention to the stipulations of the treaty, and when the Government was involved in difficulties in Italy, the Protestants took the opportunity again to rise in arms (1625). Soubise, with a fleet furnished by the town of La Rochelle, more than once defeated the weak royal navy. Cardinal Richelieu, who had assumed control of the affairs of State in 1624, was a believer in absolutism. He sought to overthrow the Huguenots as a political force, and pursued this end relentlessly. He took charge himself of the siege of La Rochelle, the Huguenot stronghold, which was taken after an heroic resistance, October 28, 1628. The fall of La Rochelle was speedily followed by that of Nîmes, Montauban, and all the other Protestant strongholds. The Peace of Alais, June 27, 1629, put an end once for all to the Huguenots as a political party. Richelieu was a great statesman and politician, and when the political power of the Huguenots was broken, he endeavored by conciliation to attach to the State these people, of whom some were the best and most useful in France. This policy was not changed under Mazarin, and Colbert during his years of power restrained Louis XIV. from persecution. After Colbert's death, the King entered upon a rigorous policy of repression, under the influence of religious conviction. Political motives, however, may have served to determine the policy of Louis XIV.; for the presence of a powerful element in the country differing in belief and to some extent in political theory from the generally accepted doctrines, must have clashed with the Grand Monarch's ideal of a nation dwelling in peaceful uniformity under the wing of a benevolent autocracy. The Huguenots were deprived of civil rights, and in the southern provinces, where Protestantism was strong, recourse was had to severer measures. To force them into the bosom of the Church, the people were handed over to the mercies of a licentious soldiery. Detachments of troops were quartered on the inhabitants, while bodies of cavalry patrolled the country, demolishing the places of worship, and in some cases putting the Huguenot preachers to death. (See DRAGONADE.) Hundreds of thousands of Protestants fled to Switzerland, the Netherlands, England, Germany, and the West Indies, as well as to South Carolina, New York, Massachusetts, and other North American Colonies. The climax of this persecution was the revocation, October 22, 1685, of the Edict of Nantes, which deprived the Huguenots of their last defense, and gave a new impulse to the emigration which took the best blood of France to strengthen her rivals. Thousands betook themselves to the mountains of the Cévennes, and continued the exercise of their religion in secret. Among these and the mountaineers of the Cévennes, a remarkable fanatical enthusiasm displayed itself, and under the name of Camisards (q.v.) they maintained for a number of years a wonderfully successful opposition to the forces of the great monarchy. The War of the Cévennes, or Camisard War, began in 1702 and was not terminated until 1705, sporadic outbursts continuing until 1709 or 1710. The suppression of the local rebellion was attended with circumstances of great cruelty. France, after the revocation of the Edict, lost more than 200,000 of her population, among them many of wealth and position, besides a number of the middle classes engaged in mechanical pursuits. The total emigration is variously estimated from two hundred thousand to a million; while, notwithstanding the many persecutions, about one million Protestants remained.

The partial repose which the Protestants enjoyed for more than ten years was attended by a revival of their worship, especially in Provence and Dauphiné. In 1724, therefore, Louis XV., influenced by political motives, issued a severe edict against them. The spirit of the age, however, now began to be opposed to persecution. An edict in 1752 declared marriages and baptisms by Huguenot ministers to be null, and required the repetition of them by the Roman Catholic clergy. But when, upon this, many began again to flee from their country, the disgust of the Roman Catholics themselves was so much excited that the Court recalled the edict. Montesquieu and Voltaire successfully advocated the cause of toleration.

FRENCH PROTESTANTISM IN THE NINETEENTH CENTURY. The first movement toward toleration of Protestantism after the revocation of the Edict of Nantes was the edict of Louis XVI., in 1787, legalizing Protestant marriages. By the concordat concluded between Napoleon and Pope Pius VII., in 1801, Protestantism (Calvinist and Lutheran) and Judaism became, with Catholicism, established religions, with equal protection and a proportional measure of State support, but subject at the same time to the strictest Government control. By the concordat religion became a part of government, and religious liberty was lost. No Church was permitted to make converts from any other, though this law soon became a dead letter with regard to the Roman Catholic Church. The Protestant General Synod was put down; particular synods could be convened only by Government; undue ecclesiastical power was given to consistories (elected presbyterial committees), tending to the disintegration of the Church and opening the way for later divisions. The parishes were few in number, most of them very extensive, and more than half of them (100 out of 171) without pastors. Under these circumstances religion became a mere form, or simply the expression of a political idea. The confirmation of the young, irrespective of religious experience, was a measure of self-preservation. Brilliant exponents of Protestantism at this time were Madame de Staël and Benjamin Constant.

A revival of French Protestantism from its depleted condition after the Revolutionary period and the subsequent political turmoil, during which it suffered greatly, took place under the Scottish Haldanes (see HALDANE, JAMES ALEXANDER, and ROBERT) and the English Methodist Cook (see COOK, CHARLES) in the early twenties. To the revival the formation of the Bible Society in 1819 contributed. During this period Samuel Vincent introduced German Protestant theology into France, and created a liberal movement against the narrow orthodoxy of the revival. Aggressive working being forbidden by law, there was much suffering for conscience' sake. In 1826 the Catholic Prince de Salm was exiled for having embraced Protestantism. Debarred thus from normal activity, the awakened Church turned to benevolent work, and the second third of the century saw the rise of a great number of strong benevolent and religious societies. The Evangelical Society was founded in 1833, the Central Society in 1847, for the building of churches. Orphanages, refuges for the blind, the deaf, for neglected, criminal, and crippled children sprang up in great profusion. Educational interests took a prominent place. In 1829 the Society for the Encouragement of Primary Instruction among Protestants was founded. In 1833 the Protestant Guizot secured the passage of the common-school law. In 1840 there were 677 Protestant schools, from primary to normal. There are two theological faculties—at Montauban, and, since Strassburg was lost, in Paris.

From this period dates also the foreign-mission work of the Protestant Church, a history of almost unparalleled zeal and self-sacrifice. The Society of Evangelical Missions was founded in 1822; the first missionaries went to South Africa in 1829. The mission-fields are now seven in number, in Africa, the Society Islands, and Madagascar. In 1901 the expenditures of the society were over 2,000,000 francs.

Protestant journalism also dates from the revival. *Le Semeur*, founded in 1831, enjoyed the collaboration of Vinet. *Le Lien* was founded in 1840 by the elder Athanase Coquerel (q.v.), to counteract the growing tendency to disintegration—a vain effort, as it proved. The narrow if profound evangelicalism of the revival produced a reaction, fostered by the liberal teachings of the theological school at Strassburg, which ended in the scission of 1842 between the orthodox and liberal wings of the Reformed Church, still held together by their relation to the State. The question of the relations between the Church and the State became a capital one; Vinet wrote a book advocating separation, and would have headed such a movement but for the powerful opposition of Guizot. The learned of that day strongly advocated it; in 1847 Lamartine declared that separation would not be too dearly purchased by a revolution. The next year (1848) the Count de Gasparin (see GASPARIN, AGENOR ETIENNE) and Frédéric Monod headed the Free Church movement. In 1849 the Union of Free Evangelical Churches of France was formed, based quite as much upon individual religious experience, in opposition to the formalism of the Reformed Church, as upon the separation of Church and State. This movement, never numerically important, barely reaching the number of fifty churches in all France, has yet been notable for the ability of its leaders—Pressensé, Bersier, Hollard, the Monods—and for its support to the orthodox, as against the liberal, wing of the Reformed Church.

The year 1852 saw a new impulse in the Church. The Sunday-School Union and the French Protestant Historical Society date from this year, and celebrated their jubilees in the summer of 1902. From this year dates also the movement toward the restoration of the synodal organization of the Reformation days, which appears now (1903) to have almost reached fruition. In 1859 the celebration of the tercentenary of the first synod of the Reformed Churches showed the deep attachment of the people to the traditions of the past.

During all this time the liberal ferment was working in the Church, a spirit not so much of *unorthodoxy* as of *freedom*. The attempt of the elder Coquerel to draw the two wings together proved sadly abortive when, in 1864, after a conflict of several years, the younger Athanase Coquerel was tried for heresy, under the leadership of Guizot, for having hailed Renan's *Life of Jesus* as a sign of revived interest in religious studies, while combating his views as to the person of Christ. Coquerel defended himself nobly, but was condemned, by 12 voices to 3, in the Consistory of Paris, and in spite of the protest of 8000 church members of that city he was deposed from the ministry, the State not interfering, as he was suffragant, not titular, pastor. He continued to preach, however, being supported by the Protestant Liberal Union (founded in 1860). Guizot's victory in this case nearly cost him his seat in the consistory. At the next election he was returned only by a majority of 8 in a vote of 2600.

In the Franco-Prussian War many Protestant pastors rendered distinguished service. At its close the Reformed Church took up the question of reorganization, the Lutheran that of the inroads caused by the loss of Alsace, which robbed it of 38 consistories and 191 parishes, while the Reformed Churches had lost 5 consistories and 26 parishes.

The twenty-ninth General Synod of the Reformed Churches had been held in 1659. Six synods held in 'the Desert' during the century of persecution had not been of national extent. The thirtieth synod was convoked by President Thiers in 1872, at the instance of Guizot. The synod memorialized President Thiers in favor of disestablishment, but in vain. A strong but vain effort was made to bring together the two wings of the Church. Since that time, no official synod of the whole Church being possible, the orthodox wing has met triennially in 'officious' synod, the liberal wing in fraternal assembly, both bodies electing representatives to the Permanent Committee, which alone is recognized by Government.

Of late years, in view of the anti-Protestant movement of the ultramontane party in the Catholic Church, and of the rapid spread of atheistic socialism, both wings of the Church have recognized the importance of union, and have earnestly sought a common doctrinal basis. Failing in this effort, in 1899 delegates from both bodies met in Lyons and formed a practical union for work in the League for the Moral and Social Improvement of the Country. This league was immediately joined by the Free and Lutheran churches, and by the Methodist and Baptist missionary churches. At the officious synod at Anduze, in May, 1902, the serious effort to find a basis of doctrinal agreement again failed, but was prophetic of union in the near future. At this synod the unanimous adoption of a resolution asking for disestablishment placed the Reformed Church in line with the advocates of Church disestablishment in France.

The establishment of the Third Republic had been the signal for a forward evangelistic movement, to which the founding of the *Mission Populaire Evangélique* in 1871 by the Rev. Robert McAll, of England, contributed much. (See Mc-

All Mission.) The law of 1878, giving full religious liberty, opened the door to an active home-mission work, already initiated in 1872 by the Interior Mission. Social questions have largely occupied the attention of Protestants. E. de Pressensé, pastor, historian, Senator, led the movement for the purification of the press, a movement which in 1902 took on new life under the energetic action of Pastor Wilfred Monod, of Rouen. Charles Robert introduced and advocated profit-sharing. Jules Siegfried headed the movement for improved workingmen's dwellings; Gide and Boyer that for business coöperation; Léon Say that for Sunday rest; Richard Waddington that for labor unions. Dr. Legrain has been prominent in the temperance movement; Pastor Robin in that for prison reform and 'assistance by work;' Pastor Arbourg in that for benefit associations; Pastor Fallot in that for public morality. Protestant pastors have a league for the study of social questions. A large proportion of the younger pastors, led by Elie Gounelle, of Roubaix, and Wilfred Monod, with many of the younger laymen, are actively promoting the movement for social Christianity, which seems better adapted than any other movement to make a stand against the rapidly growing anti-religious socialism. Among the activities of these Social Christians is the founding of 'solidarities'—social settlements distinguished not only by their evangelistic character, but by the prominence given to 'mutuality,' to works of economic betterment, and 'get-together' methods of bringing class into normal relations with class.

The latest figures for French Protestantism (census of 1893) put the number at 700,000, a gain of 176,000 over the census of 1806. Of these about 560,000 are in the Reformed (Calvinistic) Church, 80,000 in the Lutheran, 70,000 in the Free churches, and 4000 each in the Methodist and Baptist churches. The number of pastors in the Reformed Church has increased from 72 to about 1200.

The career of French Protestantism has been very closely interwoven with the modern political development of the country. Though a small minority, it has always been aggressive and resolute in maintaining its position. Many distinguished men have appeared in its ranks throughout its history. In education, law, finance, and reform it has taken a prominent part. In the founding of savings banks, the abolition of the slave trade, the revival of various industries, French Protestants have ever been foremost, and to-day are a very influential element throughout France.

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HUGUENOTS, ụ'g'-nō', Les. An opera in five acts by Meyerbeer, with words by Scribe, first produced in Paris in 1836. It is the first of the historical, as distinguished from the purely romantic operas. The plot deals with the persecutions of the French Huguenots in the seventeenth century.

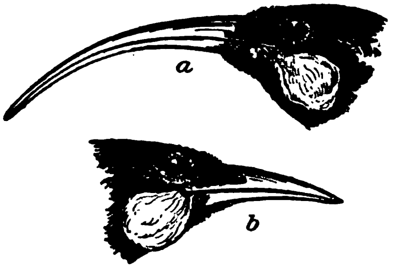
HUGUENOT SOCIETY OF AMERICA, The. An hereditary patriotic society, organized in New York City on April 12, 1883, and incorporated on June 12, 1885. Its objects are to perpetuate the memory and to foster and promote the principles and virtues of the Huguenots; to publicly commemorate at stated times the principal events in the history of the Huguenots; and to collect and preserve all existing documents, monuments, etc., relating to the genealogy or history of the Huguenots of America. Membership is extended to descendants of Huguenot families which emigrated to America or to other countries prior to the promulgation of the Edict of Toleration, November 28, 1787, as well as to writers who have made the history of the Huguenots a special subject of study. The insignia of the society consists of a badge, pendent from a gold dove with spreading wings surmounted by a rising sun, and worn on a watered-silk ribbon of white, bordered with red, white, and blue. The badge itself is of gold, surrounded by a wavy, ornamental border, and bearing on the obverse the device of Marguerite de Valois, a marigold turning toward the sun, and a ribbon with the motto, "Non Inferiora Secutus," while on the reverse is the name of the society, as well as the name of the member and number of the insignia. This society has its headquarters in New York City, where a valuable library, consisting of Huguenot books, manuscripts, etc., has been collected. There are branch societies in several States and cities, notably in Virginia, Pennsylvania, South Carolina, and New Jersey. Its publications are known as *Collections of the Huguenot Society of America.* In 1898 it celebrated the tercentenary anniversary of the promulgation of the Edict of Nantes, at which delegates from societies abroad were present, and a memorial volume containing a full account of the exercises was published in 1900.

HUGUENOT SOCIETY OF LONDON, The. An organization established in 1885, by descendants of the Huguenot refugees. Its objects are the collection and publishing of knowledge relating to the history of the Huguenots. The society consists of an unlimited number of fellows and twenty honorary fellows, and meets four times a year, with a summer conference at some place of historic interest. The society issues annual volumes of "Proceedings," and has also published fifteen volumes of church registers, lists of aliens, and letters and dispatches.

HUGUES, ụg, Dominique Jean Baptiste (1849—). A French sculptor, born at Marseilles. He studied under Dumont and Bonnassieux at the Ecole des Beaux-Arts, and made his first success with a bas-relief of Homer, in 1875. His works have frequently appeared in the Salon, such as "Le baptême du Christ" (1878); "Œdipe à Colone" (1882); and "Jeune Romaine" (1889); and he contributed "L'Asie" (1886) to the decoration of the Paris Hôtel de Ville.

HÜHNE, hụ'ne, BERNHARD (1547-1611). A German navigator in the service of Spain. He was born in Heidelberg, and by 1599 was head pilot of the Spanish colonies of North America, whence he embarked on the Pacific with Juan Fernandez (1600), to discover an outlet into Bering Sea, as California was then considered an island. The first voyage resulted merely in strife with the aborigines, but the following year Hühne set out alone, and though he did not find the mythical wealthy city of Anlan, which Philip III. had bidden him seek, he explored the Gulf of California, and made charts of it most useful to later navigators.

HUIA (hōō'yȧ) **BIRD** (Maori name). A remarkable bird of New Zealand (*Heterolocha Gouldi*), now considered one of the starling family, and approaching extinction, because it is confined to the limited forests of certain mountain ranges, and is constantly pursued as a cage-bird or as a curiosity, and also by the natives, who regard its tail-feathers as a proper badge of mourning. It is about the size of an American thrush, and both sexes are glossy green-black, excepting a white terminal band upon the tail and the large rounded wattles at the gape, which are orange-red. Their ivory-white bills, however, differ to a degree unknown elsewhere among birds. That of the female is long, slender, curved, and hoopoe-like; that of the male only half as long and much straighter and shorter. Sir William Buller has described the species very fully (*Birds of New Zealand*, London, 2d ed. 1888). He says its favorite food is the grub of a large, timber-boring beetle. The male bird, with his short, stout bill, attacks the more decayed portions of the wood and chisels out his prey, while the female, with her long, slender bill, probes the holes in the sounder part, the hardness of which resists the male's weapon; and elsewhere she obtains for him grubs beyond his reach. It is not surprising to learn, in view of this coöperative work, that the pairs are devoted companions, and when one has been captured the other is easily taken. These birds nest in hollow trees.



HEADS OF HUIA.
a, female; b, male.

HUICHOL, wē-chōl' (a corruption of the native name, signifying prophet, doctor). A wild tribe of the remote Nahuatlan stock, occupying six villages in the rough mountain region of northwestern Jalisco, Mexico. Despite former missionary efforts and long continued contact with Spanish civilization, they are said to be living in the same state of barbarism as when Cortés first put foot on the Mexican soil. Their culture is that of the well-known Pueblo type, displaying a number of ceremonial rites, especially in connection with the Peyote (q.v.), which they call Hikuli. They number 4000. Consult Lumholtz, *Symbolism of the Huichol Indians* (New York).

HUI-SHEN, hwē'shĕn'. A Buddhist monk and traveler, of the fifth century. See HWEI-SANG.

HUISMAN, hois'mȧn, ROELOF. See AGRICOLA, RODOLPHUS.

HUITFELDT, hut'fĕlt, ARILD (1546-1609). A Danish historian and statesman. After studying in Germany and France he entered the diplomatic service, and finally became Chancellor of the Kingdom. He published a long series of volumes on the history of the Kings of Denmark to the death of Christian III. These were afterwards issued under the title, *Denmarks Riges Kronike* (1650-52). The work is slovenly in style and uncritical in its judgments, but preserves many valuable documents.

HULAKU KHAN, hōō-lä'kōō Kän. See MONGOL DYNASTIES.

HUL'DA. In the mythology of Northern Germany, a spiritual being corresponding to the Berchta of Southern Germany and Switzerland, and the Frigga of Scandinavian mythology. As goddess of death, she goes at the head of the troops of ghosts. To her the souls of dying children betake themselves. She flies through the air with her attendants, bringing fortune to the good and misfortune to the evil. She sometimes has witches among her followers. See BERCHTA; FREYJA AND FRIGGA.

HULEH. See MEROM, WATERS OF.

HULL. The capital of Ottawa County, Quebec, Can., on the Ottawa River, opposite the city of Ottawa, with which it is connected by a suspension bridge (Map: Ontario, H 2). Lumber industries and large pulp and paper mills occupy the inhabitants, who are mostly French Canadians. Iron is mined in the neighborhood. The town was almost totally destroyed by fire in 1900, which also wrought considerable destruction in Ottawa, 3000 buildings in all being burned. It has been rebuilt. Population, in 1891, 11,264; in 1901, 13,988.

HULL, also known as KINGSTON-UPON-HULL. A seaport, Parliamentary and municipal borough, and civic county in the East Riding of Yorkshire, England, at the confluence of the Hull with the estuary of the Humber, 20 miles from the North Sea, and 41½ miles east-southeast of York by rail (Map: England, F 3). The town stands on a level plain amid uninteresting surroundings. The modern portion has spacious, regular, and well-paved streets, while the old quarter, which serves as the business section, has narrow crooked lanes, and is very crowded, forming an irregular peninsula. Among noteworthy public buildings are Trinity Church, founded 1412, a decorated and perpendicular building, one of the finest parish churches in England; the town hall, the new exchange, corn exchange, and market hall; there are statues of William III., erected 1734, and of Bishop Wilberforce, who was born at Hull. The chief educational establishments are the grammar school, founded in 1486; the Trinity House nautical school, 1716; Cogan's charity school for girls, 1763; the Hull and East Riding College, the Royal Institution, the literary and philosophical institute, mechanics' institute, technical school, and school of art. There are numerous charitable endowments. The municipality possesses property worth $5,000,000, which exceeds the ratable value of the town. It owns the markets, tramways, electric lighting, a profitable water-supply from springs, and maintains parks, free libraries, public baths and wash-houses, fire brigade, crematorium, sanitarium, cemeteries, refuse destructor, and disinfector.

Hull is the third port of importance in the kingdom, and has an extensive coasting, fishing, and foreign trade. It has regular communication with Germany, Russia, Holland, Belgium, Scandinavia, Denmark, the United States, India, and Australia, and is the seat of a United States consul. It exports the woolen and cotton goods of the midland counties, coal, oil, machinery, and mill work, and imports cattle, grain, timber, wool, flax, hemp, tallow, pitch, etc. It has capacious docks covering 200 acres; its shipping comprises 235 sailing and 632 steam vessels, with a total of over 228,400 tons, and a fishing fleet of 500 boats. An average of 6000 vessels enter, and clear a gross tonnage of 6,160,000 annually. The average annual value of its exports during the five years ending in 1900 was $100,000,000, and of its imports, $150,000,000. Oil-mills, iron ship-building yards, engineering-works, foundries, rope and sail making, tanneries, breweries, chemical and color works, and the many industries of a large seaport, afford employment to thousands of workmen.

The town is governed by a mayor, 14 aldermen, 42 councilmen, a recorder, and a sheriff. It sends three members to Parliament. Originally consisting of Myton and Wyke, two villages, as Myton-Wyke, it developed into an important port shortly after the Conquest. In 1298, struck with its advantages as a port, Edward I. purchased it, renamed it Kingston-upon-Hull, and gave it the charter of a free borough. Its fisheries and trade prospered under the enterprise of its merchant princes, the De la Poles, and in 1339 it supplied Edward III. with 16 ships and 466 seamen for his armament against France. In 1588 it furnished Elizabeth with £600 and 800 men against the Spanish Armada. It adhered to the Parliamentary cause during the Civil Wars, and the Governor, refusing to admit King Charles, precipitated hostilities; it successfully resisted two long sieges by the Royalists. In 1534 it was made the seat of a suffragan bishop, and again in 1891. After the fifteenth century its commercial importance increased with its imports of fish from Iceland; it was one of the first ports to engage in, and until late in the nineteenth century was the headquarters of the whale fishery. Population, in 1801, 29,500; in 1851, 84,700; in 1891, 200,500; in 1901, 240,600. The annual death-rate averages 19.6 per 1000. Consult: Symons, *Hullinia, or Selections from Local History* (Hull, 1872); Sheahan, *History of Hull* (Beverley, 1864); Freeman, *English Towns* (London, 1883).

HULL, Charles Henry (1864—). An American scholar, born at Ithaca, N. Y. He graduated at Cornell University in 1886, and then studied at the universities of Göttingen, Halle, and Berlin. He was appointed assistant professor of political economy at Cornell, and in 1901 professor of American history. He edited *The Economic Writings of Sir William Petty,* which was brought out by the University Press at Cambridge, England.

HULL, Isaac (1773-1843). An American naval officer. He was born at Derby, Conn., became a cabin boy on a merchant vessel at the age of fourteen, soon showed great aptitude for the handling of a ship, and before he was twenty-one was placed in command of a merchantman. In 1798 he entered the United States Navy as lieutenant, serving for several years on the *Constitution*, and becoming first lieutenant in 1801; and, after distinguishing himself against the French at Port Plate, Haiti, participated, as commander of the *Argus*, in the war with Tripoli. He became captain in 1806, and at the opening of the War of 1812 was in command of the *Constitution*. While on his way from Annapolis to New York in July, 1812, he escaped by masterly seamanship from a British squadron of five strong men-of-war, which pursued him for three days. On August 19th he fought his celebrated engagement with the *Guerrière*, a slightly weaker British frigate, which after a brief conflict was forced to surrender. (See Constitution, The.) In this battle his seamanship is pronounced by naval critics to have been almost perfect. The victory was the first obtained by the Americans over the British in this war, and aroused the greatest enthusiasm throughout the United States. Subsequently he was a member of the Naval Board, was at the head of the Boston and New York navy yards, and as commodore, was in command for a time of squadrons in the Pacific and the Mediterranean. He is regarded by naval critics as the ablest single-ship commander on either side during the War of 1812.

HULL, William (1753-1825). An American soldier. He was born in Derby, Conn., graduated at Yale in 1772, studied law at Litchfield, Conn., and was admitted to the bar in 1775. In July, 1775, soon after the outbreak of the Revolutionary War, he entered the American Army as a captain, and served thereafter until the close of the war, taking part in the battles of Trenton, Princeton, Saratoga, and Monmouth, leading a column in the assault on Stony Point, and rising (August, 1779) to the rank of lieutenant-colonel. After the war he removed to Newton, Mass., became major-general of Massachusetts militia, and was elected to the State Senate. In 1805 he was appointed, by President Jefferson, to the Governorship of the Territory of Michigan, which position he held until 1812, when he was raised to the rank of brigadier-general and placed in command of the Northwestern Army. He joined his troops at Dayton on May 25th, and led them through the wilderness to Detroit, where he arrived on July 5th, having heard three days before of the declaration of war against England. On the 12th he took the offensive and crossed over to Sandwich, Canada, but wasted time in issuing futile proclamations, and, soon becoming alarmed, recrossed to Detroit. On August 16, 1812, intimidated by the aggressive movements of the British

General Brock, he surrendered without making any real attempt at resistance. A general outcry was raised against Hull, and finally, on March 26, 1814, a court-martial, assembled at Albany, N. Y., sentenced him to be shot. This sentence was approved by President Madison, who, however, remitted the punishment. There has since been much controversy over Hull's case, but it is now pretty generally agreed by historians that though he surrendered with unsoldierly alacrity, and might possibly have preserved Detroit and his army altogether, the blame for his surrender must rest fully as much with the Administration as with himself. Consult: Hull, *Defense of Brigadier-General Hull, with an Address to the People of the United States* (Boston, 1814); Forbes, *Report of the Trial of Brigadier-General Hull* (New York, 1814); and the somewhat biased *Revolutionary Services and Civil Life of Gen. William Hull, Together with the History of the Campaign of 1812, by James Freeman Clarke* (New York, 1848), by Maria Campbell, Hull's daughter.

HUL'LAH, John Pyke (1812-84). An English musical composer, teacher, conductor, and lecturer. He studied the organ and piano under W. Horsley, and singing under Crivelli at the Royal Academy of Music. He was one of the most important factors in modern English musical life, and accomplished more for the cause of music among the masses than any other English musician of the century. In 1840, while pursuing his studies in Paris, he was much impressed with the French system of tuition, and upon his return to London in 1841 prevailed upon the national education committee to permit him to use a modification of it in his singing school for schoolmasters, which he inaugurated at Exeter Hall. His ideas and reforms met with determined opposition from the very beginning, but notwithstanding it is recorded that in the twenty years from 1840 to 1860 over 25,000 people availed themselves of the advantage of his classes. In 1847 his pupils and friends built and presented to him a building known as Saint Martin's Hall, in which his pupils could give their public performances. He held appointments as professor of singing at Kings, Queens, and Bedford colleges, and succeeded Horsley, in 1858, as organist of Charter House. From 1870 to 1873 he led the Royal Academy concerts, and for several years conducted the annual concert of the metropolitan school-children, held at the Crystal Palace. In 1872 he was appointed Government inspector of training schools. Besides three operas, which have but a local significance, he was the composer of many successful and widely known part-songs, motets, anthems, and songs. His published writings cover every phase of musical art and æsthetics, and include: *A Grammar of Vocal Music* (1843); *A Grammar of Musical Harmony* (1852); *A Grammar of Counterpoint* (1864); *The History of Modern Music* (1862); *The Third or Transition Period of Musical History* (1865); *The Cultivation of the Speaking Voice* (1870); *Music in the House* (1877). He received the degree of LL.D. from Edinburgh University; was elected member of the Cecilia Society of Rome, and member of the Academy of Music in Florence. He died in London.

HULL HOUSE. A social settlement, situated at 335 South Halsted Street, Chicago. It has been a leader in the social settlement movement in the United States. The old residence of Charles J. Hull, used as a junk-shop and tenement-house in the midst of a foreign and poverty-stricken population, was repaired, beautified, and opened as a settlement in 1889 by Miss Jane Addams (q.v.) and Miss Ellen Starr. All the usual features of a settlement are maintained; new buildings have been added, including a coffee-house, a children's building, and a gymnasium. The distinctive features are its attractive buildings, its close connection with the life of the Nineteenth Ward and with social work in Chicago, its large constituency, and the broad interests of its residents, who have held State or city offices such as factory inspectors or street inspectors, or who have been students conducting special investigations. See Social Settlements.

HULLIN, ụ'lăN', Pierre Augustin, Count (1758-1841). A French general of the First Empire, born in Paris. He was one of the leaders in the attack on the Bastille, and tried to rescue Delaunay. He took part in all the great days of the early Revolution; but was too moderate for some of his fellows, and was imprisoned during the Terror. On his release he entered the Italian Army, and in 1796 became Bonaparte's adjutant-general. He was appointed president of the military court which sentenced the Duke d'Enghien (1804), and he wrote, in the attempt to shift the blame on Talleyrand, *Explications offertes aux hommes impartiaux,* etc. (1823). He was made count in 1809, commanded a division under Napoleon, was one of his most trusted servants, and in 1812 was Governor of Paris. When the Emperor was sent to Elba, Hullin tried to ingratiate himself with the new régime, but failed. In 1815, during the Hundred Days, he was again Governor of Paris, but afterwards was banished to Brussels and lived for a time at Hamburg. He was pardoned in 1819, and returned to France.

HÜLLMANN, hụl'mân, Karl Dietrich (1765-1846). A German historian, born at Erdeborn, and educated at Halle. He became in 1797 professor of history at Frankfurt-on-the-Oder, and in 1808 at Königsberg. Ten years afterwards he was made the first rector of Bonn, and began his important service to that university. His principal works are: *Deutsche Finanzgeschichte des Mittelalters* (1805); *Geschichte des Ursprungs der Regalien in Deutschland* (1806); *Geschichte des Ursprungs der Stände in Deutschland* (2d ed. 1830); *Geschichte des byzantinischen Handels* (1808); *Staatsrecht des Altertums* (1820); *Das Städtewesen des Mittelalters* (1825-29), his most valuable work; *Römische Grundverfassung* (1832); *Staatsverfassung der Israeliten* (1834); *Handelsgeschichte der Griechen* (1839); *Griechische Denkwürdigkeiten* (1840); and *Geschichte des Ursprungs der deutschen Fürstenwürde* (1842).

HUL'SEAN LECTURES. A course of lectures given annually at Cambridge, founded by the Rev. John Hulse, of Elworth, in the County of Chester. He was educated at Saint John's College, Cambridge, and at his death, December 14, 1790, bequeathed the bulk of his property to his university. His will provided for the founding of two divinity scholarships in Saint John's College, the Hulsean prize, the office of Christian advocate, and that of Hulsean lecturer or Christian preacher. By a statute confirmed by the Queen in council in 1860, the office of Christian advocate was changed into the Hulsean professorship of divinity. The office of Hulsean lecturer, or preacher, is an annual one; and the duty of the lecturer is to preach not fewer than four, nor more than six sermons before the university in the course of the year. The list of Hulsean lectures, from their beginning in 1820 down to 1893, is given in Hurst, *Literature of Theology*, pp. 32-34. To which add: 1894-95, A. Barry, *The Ecclesiastical Expansion of England* (1895); 1896-97, S. Cheetham, *The Mysteries, Pagan and Christian* (1897); 1898-99, J. M. Wilson, *The Gospel of the Atonement* (1899); 1900-01, F. H. Chase, *Credibility of the Book of the Acts of the Apostles* (1902).

HULTSCH, FRIEDRICH (1833—). A German philologist, born in Dresden. He was educated at Leipzig, where he taught in the Nikolaischule, and after several years at Zwickau became professor in the Kreuzschule of Dresden, of which he was rector from 1868 to his retirement, in 1889. Hultsch's especial study was ancient mathematics. He edited the *Scriptores Metrologici* (1864-66); *Heronis Geometrica et Stereometrica* (1864); *Polybii Historiæ* (1867-72); *Pappus* (1876-78), for a large part of the text an editio princeps; and *Autolyci de Sphæra quæ Movetur Liber* (1885); and wrote the very valuable *Griechische und römische Metrologie* (1862, 2d ed. 1882); *Die Elemente der ägyptischen Teilungsrechnung* (1895), and *Die Gewichte des Altertums* (1898).

HUMAITÁ, o͞o-mä'ê-tä'. A town and fort of Paraguay, situated at the southwestern end of the country, on the river Paraguay, near its confluence with the Paraná (Map: Paraguay, F 9). During the War of the Triple Alliance it was besieged for over a year by the forces of Argentina and Brazil, and finally surrendered in 1868. The fortifications were razed at the end of the war (1868-70). The surrounding region yields rich crops of cotton, tobacco, coffee, and sugar. Population, about 4000.

HUMANE ASSOCIATION, AMERICAN. A federation of societies of the United States for the prevention of cruelty to animals and children, formed at Cleveland, Ohio, in 1877, at a meeting held to consider the maltreatment of animals in transit between the East and West. It became a national organization, whose purpose was at first to deal with interstate traffic. It sent representatives to influence legislation at Washington, and its agents investigated the abuses which prevailed on lines of railways transporting cattle. It offered a prize of $5000 for the best model of a cattle-car that would make possible the feeding, watering, and resting of cattle in transit, as the result of which many improved cars were brought into use. In 1884 it won a suit in Massachusetts against two leading railroads for violation of the law, thus establishing an important precedent. For many years its purpose has been that of a federation of all local humane societies. It carries on considerable work of an educational nature. It has instituted inquiries in the United States and abroad on the subject of vivisection in the schools and colleges. Prizes were offered, in 1900, to college and medical students, for essays on vivisection, its abuses and their remedy. Its most recent undertaking is the raising of money to organize humane societies in States where they do not now exist. The secretary is Francis H. Rowley, Brookline, Mass. See CRUELTY TO CHILDREN, and CRUELTY TO ANIMALS, PREVENTION OF.

HUMANE SOCIETY, ROYAL. An organization for the recovery of persons apparently drowned, founded in England in 1774. It maintains receiving houses in appropriate places along the Thames, and near canal banks, and in various parts of London. The chief station is on Serpentine River in Hyde Park, on ground given by George III., and was erected in 1794. The seal of the Society bears the unique motto, *Lateat Scintillula Forsan* ('a small spark may perhaps lie hid').

HUMANISM (from *human*, OF., Fr. *humain*, from Lat. *humanus*, relating to man, from *homo*, OLat. *hemo*, man; connected with AS. *guma*, man, Gk. χθών, *chthōn*, Skt. *kṣam*, earth). A name applied to the literary movement at the close of the Middle Ages, whose object was the revival of the pagan learning of classical antiquity. The humanists from the beginning divided into two divergent schools, one of which sought to engraft the classical learning on the tree of Christianity, while the other endeavored to revive not merely the literature of classical antiquity but, through this, the pagan spirit of the ancient heathen cults. The first humanistic movement began in the fourteenth century in Italy, where the political and social developments were preparing the way for a departure from mediæval traditions. The numerous small Italian States, despotic and republican alike, favored the development of individuality at a time when feudalism (q.v.), still in existence in other parts of Europe, gave less opportunity for the exercise of individual activities. The ferment of Italian politics gave the individual freer play, and the sense of personal independence was rapidly tending to looser social and political ideals. Paganism in Italy, though overpowered, had never been completely exterminated. It had lived on in popular legend and retrospective pride of race, and in countless associations connected with the Roman Forum, the Coliseum, and other historic monuments. But these survivals from ancient Rome were an insignificant moment in mediæval Italian culture; the pagan past did not seriously influence men's minds till new social and political conditions had prepared the way for the revival of classical ideals. (See RENAISSANCE.) The exile of the Papal See from Rome for nearly three-quarters of a century (see AVIGNON) must also have acted as a removal of the great check against the recrudescence of paganism. In the fourteenth century all Italy was astir with the new life. Dante, as is shown in his homage to Vergil, felt the new impulse. Petrarch, who may be regarded as the first Christian humanist, threw himself into the van of the new movement. His passion for antiquity and his intolerance of certain forms of mediævalism were boundless. He devoted great energy to the discovery and rescue of Latin manuscripts, to the collection of old Roman coins and other antiquities, and to scathing denunciation of scholastic philosophy, jurisprudence, and medicine. But while the mediævalist had looked forward to an immortality beyond the grave, the pagan humanist would be satisfied with nothing less than an earthly immortality, achieved by poetry like Vergil's and prose like Cicero's. And as the literary style of the Augustan age (q.v.) became the sole model for the writer, so the spirit of antiquity, with its sensuous attitude toward life and nature, its unqualified secularity, its abandonment to the charm of things seen and temporal, controlled the humanists' thought and conduct.

A second humanistic movement—more properly called humanitarianism—came to its culmination in Comte's (q.v.) worship of humanity. It finds in man the highest and worthiest object of esteem and reverence, and is hostile to any theory which places the divine outside of the human. It is differentiated from the pagan Renaissance attitude most markedly by its placing the golden age of man's development not in the past, but in the future.

Consult: Burckhardt, *Die Cultur der Renaissance in Italien* (Basel, 1860; 3d ed. 1877-78), English translation by Middlemore (London, 1878 and 1891); Voigt, *Die Wiederbelebung des klassischen Altertums oder das erste Jahrhundert des Humanismus* (Berlin, 1859; 2d ed. 1880-81); Symonds's (q.v.) works on the Renaissance, epitomized by Pearson in *A Short History of the Renaissance in Italy* (New York, 1893); Owen, *Skeptics of the Italian Renaissance* (New York, 1893); Jebb, *Humanism in Education*, Romanes Lecture (London and New York, 1899); Pastor, *History of the Popes* (London, 1891); Einstein, *The Italian Renaissance in England* (New York, 1902); Gasquet, *The Eve of the Reformation* (London, 1898).

HUMANITARIANS (from Lat. *humanitas*, humanity, from *humanus*, human). The name assigned to the several classes of anti-Trinitarians, who regard Christ as a mere man, and refuse to ascribe to Him any supernatural character, whether of origin or of nature. Theodotus of Byzantium, called the Tanner, a Monarchian (q.v.), is said to have been excluded from the Church by Victor, Roman Pontiff (189-198), because, having denied Christ in time of persecution, he afterwards defended himself by declaring that in so doing "he had denied not God, but man." A contemporary and probably an associate of Theodotus, Artemas, taught in like manner that Christ was a mere man. Theodotus and Artemas probably represent a school or sect at Rome, and were the first to formulate the doctrine, so far as known. (See the articles SOCINUS; UNITARIANISM.) The name humanitarian is also sometimes applied to the disciples of Saint-Simon (q.v.), and in general to those who look to the perfectibility of human nature as their great moral and social dogma, and ignore altogether the dependence of man upon supernatural aid, believing in the all-sufficiency of his own innate powers.

HUMANITIES. A term now employed primarily to designate the study of the classical literatures of Greece and Rome, and the various sciences which deal with them, such as grammar, classical philology, etc.; but sometimes secondarily it includes all 'culture studies' in contrast to professional studies. Cicero, Aulus Gellius, and other Latin writers used *humanitas* in the sense of culture becoming to a man and gained by the study of the great masterpieces, mostly of Greek literature, but not exclusive of Roman. The scholastics adopted the term especially in the form of *literæ humaniores* (the more humane letters), but gave it a different emphasis by placing it in contrast and in subordination to *divinitas* (divinity or theology). This contrast gave to humanity an enlarged meaning, including all forms of secular learning. The humanistic movement (see HUMANISM) restored the word to its Ciceronian significance. But when the narrowness of humanism in regarding the study of the ancient classics as the means *par excellence* of gaining humane culture came to be appreciated, and when other sciences of liberal character arose, the term humanities began gradually to take on a larger meaning, and it is now used by some authorities to include all philological study, together with history, philosophy, political science, economics, and all other sciences which concern themselves with human civilization. In the Scotch universities, however, the singular, 'humanity,' is used to designate the study of the Latin language and literature.

HUMANN, hōō'mȧn, KARL (1839-96). A German engineer and archæologist, born at Steele. In 1861 he gave up his studies, as he was ordered south because of his health. In Samos he made successful excavations of the famous Temple of Hera. In 1862 he built Sir Henry Bulwer, English Ambassador at Constantinople, an island palace; two years later was employed by the Turkish Government to survey Palestine for a railroad from Jaffa to Jerusalem; and, after a trip to Egypt, mapped out the Eastern Balkans, after surveys ordered by Fuad Pasha. But besides the name he made for himself by these maps, and by engineering in Northern Asia, he got fame for his excavations at Pergamus (1878-86); was made honorary doctor by the University of Greifswald, director of the Museum of Berlin, and Privy Councilor (1894). His later excavations were at Senjirli, in Northern Syria, at Tralles, and Magnesia. With Conze, Bohn, and others, he published *Die Ergebnisse der Ausgrabungen zu Pergamon* (1880-88), and with Puchstein, *Reisen in Kleinasien und Nordsyrien* (1890).

HUMAYUN, hōō'mȧ-yōōn'. A Great Mogul of India, son of Baber and father of Akbar. He came to the throne in 1530, but after ten years of successful warfare was defeated by the Afghan Sher Khan and driven from India. He took refuge at the Court of Persia, and with a Persian army returned in 1555, and recovered control of Delhi and Agra. He died at Delhi, where a great mausoleum was built for him.

HUM'BER. The continuation and estuary of the rivers Ouse and Trent, between the English counties of York and Lincoln (Map: England, G 3). It is 38 miles long and from 1 to 7 miles broad, with Hull on its north shore and Great Grimsby on the south. It was the entrance for the Norse invasions of the ninth and tenth centuries.

HUMBERT I. (Ital. UMBERTO) (1844-1900). King of Italy from 1878 to 1900. He was the eldest son of Victor Emmanuel II. and Adelaide, Archduchess of Austria, and was born at Turin, March 14, 1844. At an early age he obtained an insight into political and military life under the guidance of his father, during the war of 1859, although he was then too young to take an active part in the struggle. He was more closely connected with the process of the unification of Italy which followed. In July, 1862, he visited Naples and Palermo, where he shared the popularity of Garibaldi. When the war between Prussia and Austria was imminent, Humbert was dispatched to Paris to ascertain the sentiments of the French Government in reference to the alliance between Italy and Prussia. On the outbreak of hostilities he hastened to take the field; obtained the command of a division of General Cialdini's army, with the rank of lieutenant-general; and took a gallant part in the battle of Custozza, June 24, 1866, covering the retreat of the Italians by brave and skillful tactics. In 1868 he married his cousin, the Princess Marguerite of Savoy. He succeeded to the throne on the death of his father, January 9, 1878. He showed great bravery during the cholera epidemic in 1884, and gained in popular esteem by his visit to Naples at that time. In 1887 the foreign policy of the Government resulted in the Triple Alliance between Italy, Austria-Hungary, and Germany. The colonial policy of the country was not so successful, however, as the Italian troops met with great reverses in Abyssinia in 1887, and again in 1895. In 1898 a commercial treaty was concluded with France, but throughout Humbert's reign the country suffered under financial depression and heavy taxation. Toward the end of his reign King Humbert lost some of his former popularity. An anarchist attempted to assassinate him before the gates of Rome in 1897, but failed. Three years later, however (July 29, 1900), Humbert was shot at and mortally wounded by another Italian anarchist, Bresci, who had come from the United States intent on this act. The King died almost immediately. Humbert was succeeded by his only son, Victor Emmanuel III. See Italy.

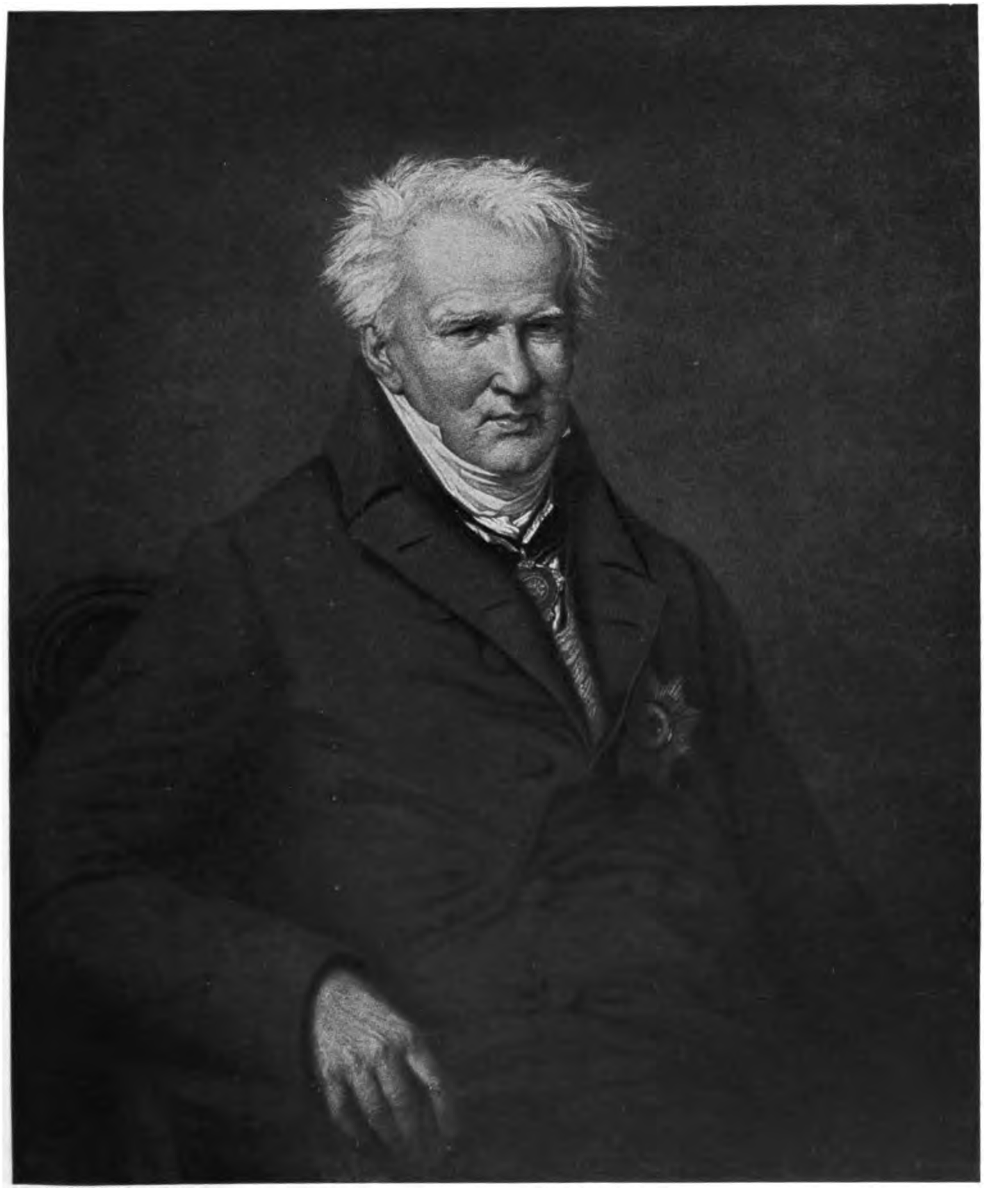
HUMBERT, ĕɴ'bâr', Ferdinand (1842—). A French painter, born in Paris. He studied with Picot, Cabanel, and Eugène Fromentin. His first appearance in the Salon was in 1865, with "La fuite de Néron." Besides portraits, he painted numerous canvases upon religious or historical subjects, such as "Le Christ à la Colonne" (1875), which is now in the Orléans Museum, and "Pro Patria," a decoration for the Panthéon (1886). He was awarded several medals, and was made an officer of the Legion of Honor.

HUMBERT, Gustave Amédée (1822-94). A French jurist and politician, born at Metz. He studied law in Paris, and gave private lessons both before and after he was under-prefect of Thionville (1848-51). He was professor of Roman law at Toulouse, and thence entered politics in 1871 on his election to the Chamber of Deputies. Humbert took a prominent part in debates on legal questions, became a leader of the Republican Left in 1875, was transferred to the Senate, and in Freycinet's Cabinet (1882) was Minister of Justice. In 1890 Humbert left his post as vice-president of the Senate, and became president of the chief court of accounts. He wrote: *Essai sur les finances et la compatibilité publique chez les Romains* (1887), and *Organisation de l'empire romain* (1892). His connection with the great Humbert swindle, carried through by his son, Frédéric, and his daughter-in-law, Frédéric's wife, is problematic.

HUMBLEBEE. See Bumblebee.

HUMBOLDT, hŭm'bōlt. *Ger. pron.* hụm'bōlt, Alexander, Baron von (1769-1859). A German naturalist and traveler. He was born in Berlin, September 14, 1769. His father, who died in 1779, was a chamberlain to the King of Prussia; his mother was of Burgundian descent, and his youthful life was spent in the old Castle of Tegel, near Potsdam. He studied, in company with his brother Wilhelm (q.v.), first under private tutors, then at the universities of Frankfort-on-the-Oder, Berlin, and Göttingen. His preference for scientific studies was strongly manifested in his early years, and highly developed by the influence of Blumenbach and other university instructors. During his residence at Göttingen (1788 and 1789) he made geological examinations in the Harz Mountains and Rhine Valley, which resulted in his first important publication, *Ueber die Basalte am Rhein, nebst Untersuchungen über Syenit und Basanit der Alten* (1790). In 1790 Humboldt made a tour through France, the Netherlands, and England, in company with Georg Forster, already eminent as a scientific traveler, whose influence was strong in shaping the younger man's career; and in 1791 he entered the Academy of Mining at Freiberg, Saxony, where Werner was then professor of geology. His eight months' residence at Freiberg gave him materials for several technical papers in chemistry and physics, and for some more elaborate essays, especially those upon the cryptogamous plants of the mines (*Flora Subterranea Fribergensis*, etc.). In consequence he was soon (1792) appointed superintendent of mines in the principalities of Bayreuth and Anspach, and resided for the next three years at Bayreuth. The breadth of his interest and researches at this period is exemplified by his work and speculations on the nature of muscular and nervous force, entitled *Versuche über die gereizte Muskel- und Nervenfaser, nebst Vermutungen über den chemischen Prozess des Lebens in der Tier- und Pflanzenwelt* (1797).

The desire for larger freedom, and especially for exploratory travel, led Humboldt to resign his office in 1797. He had already in 1795 wandered about the Alps, studying geology, but further intended journeys to Sicily and up the Nile were prevented by political obstacles. The next three months were spent at Jena, in intimate association with Goethe, Schiller, and the men at the university, who then made an extraordinary circle of intellects: and here he began to plan for the great journey to Spanish America with which his fame is now most closely associated. In Paris he made the acquaintance of a talented young French botanist, Aimé Bonpland, who joined in his plans and was destined to be his principal colaborer. Meanwhile Humboldt was incessantly at work, and the years 1797-99 witnessed the publication of many notable contributions to science, among which those pertaining to the composition of the atmosphere were particularly notable. Many of these were brought together in his book *Versuche über die chemische Zerlegung des Luftkreises* (1799). At length, after spending some time in Spain and getting letters from the Government, Humboldt and Bonpland sailed in a Spanish frigate from Coruña, in June, 1799. They visited Teneriffe, ascended the peak, and made valuable observations there, as well as at sea during the voyage, which terminated at Cumana, in Venezuela.



ALEXANDER VON HUMBOLDT

FROM AN ENGRAVING BY P. HABELMANN, AFTER A PAINTING BY EMMA RICHARDS

The travelers explored the region for upward of a year, crossing over to the upper waters of the Orinoco, and establishing the connection between that stream and the Upper Amazon. The year 1801 was spent in explorations in Cuba, the basin of the Magdalena River, and in the Andes of Quito, the famous ascent of Chimborazo, to an altitude of about 19,000 feet, being accomplished in June, 1802. The explorations were then extended to Peru, where Humboldt devoted himself largely to the electrical and astronomical studies favored by the climate, but also acquired a valuable knowledge of the cinchona (quinine) plant and its culture. From Peru the two savants took ship for Mexico, landing at Acapulco in February, 1803. There they traveled for a year, Humboldt paying special attention to the determination of positions on the map and to volcanic phenomena, and then returned to Europe by way of Cuba and the United States (where several weeks were spent), reaching Bordeaux in August, 1804.

Humboldt now went to Paris, and occupied himself with Bonpland in the arrangement of their manuscripts and collections, a large part of which, however, had been lost by a shipwreck; at the same time he pursued continuous experiments in physical chemistry. Having visited his brother, then Prussian Ambassador at Rome, and returned to Berlin, he accompanied Prince Wilhelm of Prussia, in 1807, on a political mission to France, and obtained leave from the Government of his own country to remain thenceforth in Paris for the publication of the account of his travels. He enlisted the coöperation of Gay-Lussac, Cuvier, and many others of the most eminent French specialists of the day in the elaboration of his materials, and began in 1807 to publish the results in magnificent volumes (20 in folio and 10 in quarto, illustrated by 1425 copperplates). The title was *Voyage aux régions équinoxiales du Nouveau Continent fait en 1799-1804 par Alexandre de Humboldt et Aimé Bonpland.* The first 14 volumes were devoted to botany, and were actually prepared mainly by C. S. Kunth; vols. xv. and xvi. were an 'atlas pittoresque;' vols. xvii., xviii., xix., xxi., and xxii. were devoted to physical geography, geognosy, and astronomy; vol. xx. contained a 'geography of plants;' vols. xxiii. and xxiv. were zoölogical; vols. xxv. and xxvi. were devoted to a sociological account of the countries of Spanish America; and vols. xxviii., xxix., and xxx. contained Humboldt's narrative of his journey, which was left unfinished. The original of this work contains the *Essai politique sur le royaume de la Nouvelle Espagne*, the *Essai politique sur l'île de Cuba,* and the *Vues des Cordillères.* Among the minor works of the great master, the *Ansichten der Natur* (first edition, 1808) had an immediate and widespread welcome. It was translated into almost every European language, and issued in English in both London and Philadelphia. The publication of the great *Voyage* continued at irregular intervals until 1827, and the volumes or groups of volumes appeared under individual titles, by which they are more usually known. The bibliography of Bruhns's biography of Humboldt disentangles the confusion of titles and editions which resulted, and to that the curious reader is referred. After Humboldt's death an octavo edition of his principal works was published in Paris (1864-66).

The favor of Frederick William III. of Prussia, who had settled upon Humboldt a pension of 2500 thalers, and later of 5000, required him to make frequent journeys with that monarch, and at last he was summoned to reside at the Court. In 1827, then, he took up his permanent residence in Berlin, and with much discontent endeavored to carry on his investigations amid uncongenial surroundings. One of the best results of his work at this period was his success in establishing for the first time international coöperation in furtherance of scientific observations. In 1827-28 he gave a series of remarkable lectures on physiography at Berlin, which formed the basis of his subsequent *Kosmos.* In 1829, under the patronage of the Russian Government, and accompanied by Ehrenberg and Gustav Rose, he made a rapid journey as far east as the Yenisei, one of the most striking results of which was the discovery of diamonds and other precious stones in the Ural Mountains, as Humboldt had predicted would be the case from his knowledge of their geology. Many geographical positions were astronomically determined, and erroneous views as to the physical geography of the northern interior of Russia were corrected. The record of this journey was first written by Humboldt as *Fragments de géologie et de climatologie asiatique* (1831), and afterwards enlarged into *Asie centrale, recherches sur les chaines de montagnes et la climatologie comparée* (1843).

The subsequent years were spent in occasional diplomatic journeys and in the preparation of what he deemed the crowning monument of his intellectual life, his *Kosmos,* an encyclopædic account and explanation of the physical universe. Four volumes were written and published in Berlin, in 1845, 1847, 1850, and 1858. They were translated as fast as issued into many languages, and created a profound impression.

He kept health and vitality, and continued at work until the winter of 1858-59, when his strength declined. He died May 6, 1859, and was buried with royal honors at Tegel. After his death new editions of many of his works were issued, and several collections of his letters appeared.

Humboldt's influence upon scientific thought has been vast and far-reaching. "With him," says Agassiz, "ends a great period in the history of science; a period to which Cuvier, Laplace, Arago, Gay-Lussac, De Candolle, and Robert Brown belonged." His grasp of the universe as a whole was no less remarkable than his faculty of observing and explaining single phenomena. His scenic descriptions are strikingly picturesque. Humboldt has contributed to nearly every branch of science, either by direct investigation or by the accumulation of valuable material. He may be regarded as the founder of the modern science of physical geography, and he placed meteorology upon a firm basis. We can only allude to his observations on the cultivation of the soil in different climates, and its effect upon civilization; his study of the languages, the architecture, and the customs of the ancient peoples of South and Central America; his discovery of the decrease in intensity of the earth's magnetic force from the poles to the equator; his fruitful labors in chemistry with Gay-Lussac; his experiments concerning the respiration of fishes; and his contributions to the science of geology (especially in the departments of petrography, vulcanology, and seismology).

Humboldt's published correspondence with some of the most distinguished men of his time, such as Goethe, Varnhagen, Pictet, Bunsen, Gauss, and Raumer, as well as with his brother Wilhelm, attests the almost unparalleled breadth of his intellectual interests.

The most complete and painstaking *Life* of Humboldt is Bruhns's (Leipzig, 1872); an English translation exists, less the very full bibliography. Klencke's shorter biography, also translated into English, is accurate but dull; and another is by R. H. Stoddard (New York, 1860), with additions by Bayard Taylor, which is far more satisfactory.

HUMBOLDT, Karl Wilhelm, Baron von (1767-1835). An eminent German scholar, author, and statesman, elder brother of the preceding, born at Potsdam, Prussia, June 22, 1767. He was educated at the universities of Frankfort-on-the-Oder and Göttingen, where he was especially trained in jurisprudence, but also studied æsthetics, antiquities, and the Kantian philosophy, then newly propounded. After Continental travel, he spent some time in 1789-90 at Erfurt and at Weimar, where he met Schiller, then professor extraordinarius at Jena. In 1790 he became referendary in the Supreme Court of Judicature at Berlin, with the title of Prussian Councilor of Legation, but in 1791 resigned his appointment, and in 1794-97 was at Jena, active in scientific and literary study, and one of the Schiller circle. His interesting correspondence with Schiller, extending from 1792 to 1805, was published by him in 1830 with a "Vorerinnerung" (2d ed., by Vollmer, 1876; in the *Cotta'sche Bibliothek*, ed. by Muncker, 1893). From 1801 to 1806 he was Prussian Resident Minister at the Papal Court, and in 1806-08 Minister Plenipotentiary. At Rome he was a most liberal patron of artists, including Rauch and Thorwaldsen, made philosophical, æsthetic, philological and archæological researches, and wrote the elegy *Rom* (1806), his most ambitious poem. In 1809 he was appointed Privy Councilor of State, in charge of public worship and education. After a successful administration, which introduced many reforms, and organized and obtained endowment for the Berlin University (decreed 1807, opened 1810), he resigned the post in 1810, to accept that of Envoy Extraordinary and Minister Plenipotentiary at Vienna, with rank of Minister of State. In the political affairs of the time he took a prominent part. He was present at the Peace Congress of Prague in 1813, in 1814 was at the Congress of Châtillon and signed, with Hardenberg, the first Paris Treaty, and in 1814-15 attended the Vienna Congress as Prussia's Second Plenipotentiary. Humboldt likewise took part in the negotiations attending the conclusion of the second Paris Treaty, and was a member of the Territorial Commission at Frankfort-on-the-Main in 1816-17. As a State Councilor he strongly disagreed with Chancellor Hardenberg on certain matters of tax reform, and in consequence he was ordered to London as Ambassador. He returned in 1818 to attend the Congress of Aix-la-Chapelle, and in 1819 was appointed to the Ministry of the Interior (then divided into two branches) with the department of communal and municipal affairs. His liberal opinions soon involved him in difficulties with the Government. He demanded a new Prussian constitution which should combine the autonomy of provinces and governmental districts with a Parliament chosen by direct election; and he attacked the Carlsbad decrees, which, among various provisions, established a censorship of the press and contained measures hostile to the universities and schools. Dismissed in 1819, he was not recalled to the Council of State until 1830. In the last years of his life Humboldt devoted much attention to art matters and to the organization of the Berlin Museum. He died April 8, 1835, at Tegel.

As a statesman Wilhelm von Humboldt was enlightened and industrious, but perhaps hardly constructive. As a critical essayist he was of transient influence. Of his poetical works, besides the *Rom* above mentioned, only the translation of the *Agamemnon* is now much read (1816, 2d ed. 1857; in the *Universalbibliothek* of Reclam). But as a philologist he marks an epoch. It was he who first called the attention of scholars to the phenomenon of the Basque language, particularly in the volume *Prüfung der Untersuchungen über die Urbewohner Hispaniens vermittelst der baskischen Sprache* (1821). His chief publication, *Ueber die Kawisprache auf der Insel Java* (3 vols., 1836-40), with its noted introduction, "Ueber die Verschiedenheit des menschlichen Sprachbaues" (separately printed 1835, 3d ed. of Pott's revision, 1880), was the first on the subject. Important dissertations read before the Berlin Academy include those on the comparative study of language, the province of the historian, and the origin of grammatical forms. Humboldt was in these and other writings the first to associate the science of comparative philology with philosophy, history, and other collateral studies, and to give it a universal significance. His *Ideen zu einem Versuch, die Grenzen der Wirksamkeit des Staates zu bestimmen* (edited by Cauer 1851, in Reclam's *Universalbibliothek*), which Schiller vainly tried to get published, limits the authority of the State to the inferior task of protecting the life and property of its citizens. The collected works appeared at Berlin (7 vols.) in 1841-52. Consult also the study by Haym (Berlin, 1856); Adler, *Wilhelm von Humboldt's Linguistical Studies* (New York, 1866); Gebhardt, *Wilhelm von Humboldt als Staatsmann* (Stuttgart, 2 vols., 1896-99); and Kittel, *Wilhelm von Humboldts geschichtliche Weltanschauung* (Leipzig, 1901).

HUMBOLDT RIVER. The longest river of Nevada. It rises in Elko County, in the northeast corner of the State, and flows 350 miles in a generally southwest direction, emptying into Humboldt Lake in Churchill County, 80 miles northeast of Carson City (Map: Nevada, E 1). The lake has no outlet, the water sometimes evaporating faster than the river can supply it; at times of high water it formerly overflowed into Carson Sink, but this is now prevented by a dam. The river is only a few yards wide, growing smaller by evaporation toward its mouth. Its water is saline, and it flows through an arid and barren region covered with sage-brush, with the exception of a few fertile alluvial plains and clumps of willows. The valley of the Humboldt is the only east and west pass through the mountains of Nevada, and it is followed throughout its course by the Central Pacific Railroad.

HUME, DAVID (1711-76). An English philosopher and historian. He was born at Edinburgh on April 26 (O. S.), 1711. His father was the laird of Ninewells in Berwickshire, but David, being the youngest son, had to make his fortune with no other assistance than an education and the influence of his family. He appears to have studied in the University of Edinburgh when twelve years of age, but his education for the most part consisted in home reading. His family designed the law to be his profession, and he submitted to the initial steps of the proper practical training, but it was not a pursuit to his liking. Deserting it, he experimented in a mercantile house in Bristol, but commerce was not more congenial to him than jurisprudence, and he gave it a very short trial. To use his own words, "I now went over to France with a view of prosecuting my studies in a country retreat, and there I laid the plan of life which I have steadily and successfully pursued. I resolved to make a very rigid frugality supply my deficiency of fortune, to maintain unimpaired my independency, and to regard every object as contemptible except the improvement of my talent in literature." He spent much of the next three years at La Flèche, in intercourse with the Jesuits, and then he wrote his *Treatise of Human Nature*, which, however, he did not publish till 1739-40. It consists of three books, "Of the Understanding," "Of the Passions," and "Of Morals." Now one of the three or four most famous philosophical productions of England, at the time of its appearance "it fell deadborn from the press without reaching such a distinction as even to excite a murmur among the zealots," as Hume himself acknowledged, much to his mortification. He now turned to political theory, and published anonymously in 1741-42 two volumes of *Essays Moral and Political.* In 1744 he was a candidate for the chair of 'ethics and pneumatic philosophy' in the University of Edinburgh, but his *Treatise* had given him a reputation for 'heresy, deism, skepticism, atheism, etc.,' and the university would have none of him. In 1746 he obtained a 'very genteel' appointment as secretary to General Saint Clair on "10 shillings a day, perquisites, and no expenses." An expedition had been planned to Canada, but an unsuccessful attack on L'Orient, in France, led to a recall of the general. Two years after Hume accompanied General Saint Clair to the Court of Turin, as secretary and aide-de-camp, and took notes of his impressions of Holland, Germany, and Italy.

In 1748, during his absence on the Continent, he published his *Enquiry Concerning Human Understanding.* The following year he returned to England; in 1751 he gave to the public the *Enquiry Concerning the Principles of Morals*, and in 1752 the *Political Discourses*, said to have been the 'cradle of political economy.' At the same time he also composed *Dialogues on Natural Religion*, which, however, were not published till after his death. By this time he had put by enough money to gain him an income of £50 a year. Besides he had "a hundred pounds' worth of books, great stores of linens and fine clothes, and near £100 in his pocket, along with order, frugality, a strong spirit of independency, good health, a contented humor, and an unabated love of study," as he himself relates. In 1751 he had removed to Edinburgh, and a year later he was elected librarian to the Faculty of Advocates at a salary of £40. In 1754 he published the first volume of the *History of Great Britain, Containing the Reign of James I., and Charles I.;* the second volume appeared two years afterwards. Then he took up the Tudors, and, working backward, finished his *History of England* in 1762. In 1757 he had published *Four Dissertations: the Natural History of Religion; of the Passions; of Tragedy; of the Standard of Taste.* In 1763 he was a member of the embassy to France under Lord Hertford, and there found himself famous. He was lionized by the frivolous society ladies, fêted by the nobles, and taken by the men of letters into their friendship. After his return he was made Under-Secretary of State (1767-69), and by 1769 had an income of £1000 a year. In 1770 he retired from public life and built a home in Edinburgh on a new street, which was jocularly called 'Saint David's Street,' after him. Here he wrote *My Own Life*, and here he died, August 25, 1776. His *History of England* became a classic as soon as it appeared; his economic writings were a fitting prelude to those of his friend Adam Smith (q.v.), while his philosophical works roused Kant "from his dogmatic slumber," gave rise by reaction to Scottish philosophy, and are the immortal text-books of skepticism and agnosticism. His philosophy was but the consistent development of Berkeley's idealism. (See BERKELEY.) Berkeley had denied the reality of matter, and had accounted for what passed for matter by making it a complex of sensations and ideas, but he still held to the reality of mind as the subject of sensations and ideas. Hume dropped out mind as Berkeley had dropped out matter, and thus left nothing to be known except 'perception' (impressions and ideas), together with certain fictions of the imagination, of which he gives no satisfactory account that can be made consistent with his general position. "All the perceptions of the human mind resolve themselves into two distinct kinds which I shall call impressions and ideas." These differ not by reason of any differences in the manner in which they are produced, but merely in priority and liveliness. Ideas are simply those perceptions which, appearing later than similar perceptions, are less forceful and vivid. Ideas are of two sorts, ideas of the memory and ideas of the imagination. Of these the former are the more lively, and retain, in great measure, the order and sequence of these original impressions, whereas ideas of the imagination are fainter and are "not restrained to the same order and form with the original impressions." Ideas are associated in accordance with certain principles, viz., "Resemblance, contiguity in time or place, and cause and effect." There are no general ideas. Ideas of space are complexes of *minima visibilia*, or colored points, disposed in a certain manner. These points are indivisible. Ideas of time are derived from the succession of our perceptions, and as these perceptions are in the last instance indivisible, time is not infinitely divisible. No perception has any proper external, objective reference. A cause is an object precedent and contiguous to another, and so united with it in the imagination that the idea of the one determines the mind to form the idea of the other, and the impression of the one to form a more lively idea of the other. "There is no substance, hence no mind except the bundle of perceptions. A true skeptic will be diffident of his philosophical doubts, as well as of his philosophical convictions." In ethics, Hume was a utilitarian. (See UTILITARIANISM.) Self-love cannot be the sole basis of reasonable action. 'Crucial experiments' render such a view impossible. Sympathy is a real principle in human nature, and reflections on public interest and utility are the sole sources of the moral approbation paid to fidelity, justice, veracity, integrity. Sympathy does the work it does because it is our pleasure in other persons' pleasures and our displeasure in their pains. Thus our own pleasure and pain are the springs of action, but they are not the ends of action.

A complete edition of Hume's philosophical works was published by Green and Grose (4 vols., London, 1874-75); his *Treatise* and two *Enquiries* in two volumes by Selby-Bigge (Oxford, 1889-94); his *History* has appeared in almost innumerable editions; his autobiography was edited by Adam Smith (London, 1777). Consult also: Burton, *Life and Correspondence of David Hume* (Edinburgh, 1846); and Huxley, *David Hume* (London, 1879), containing a popular account of Hume's philosophical views. For treatment of Hume's philosophy, consult: Jodl, *David Humes Lehre von der Erkenntnis* (Halle, 1871); Pfleiderer, *Empirismus und Skepsis in David Humes Philosophie* (Berlin, 1874); Meinong, *Hume-Studien* (Vienna, 1877-82); Gizycki, *Die Ethik David Humes* (Berlin, 1878); T. H. Green, *Introduction to Hume*, in Green and Grose's edition of Hume's works; also published as part of vol. ii. of Green's *Works* (London, 1885); Knight, *Hume* (London, 1886); and the various histories of modern philosophy by Ueberweg-Heinze, Falckenburg, Höffding, and Windelband.

HUME, HAMILTON (1797-1863). An Australian explorer, born in Paramatta in New South Wales. He is best known as leader with Howell of the cross-country expedition of 1824, on which, when question arose as to the part he had taken in it, he wrote: *A Brief Statement of Facts in Connexion with an Overland Expedition from Lake George to Fort Phillip, in the Year 1824* (3d ed. 1874), and, with Howell, *Journey of Discovery to Fort Phillip* (1837). He accompanied Sturt (q.v.) in his first exploration. A county in New South Wales, a mountain range in Victoria, and a river, one of the largest tributaries of the Murray, bear the name of Hume.

HUME, JOHN. See HOME, JOHN.

HUME, JOSEPH (1777-1855). A British political reformer, born January 22, 1777, at Montrose, Scotland. He was educated in the local schools of Montrose, and at the age of thirteen was apprenticed to an apothecary. He studied medicine, was admitted in 1796 a member of the College of Surgeons, Edinburgh, and became assistant surgeon in the marine service of the East India Company. He applied himself to the native languages, and during the Mahratta War, from 1802 to 1807, filled the office of Persian interpreter to the army. He also discharged duties connected with the prize agencies and the commissariat, and arrived in England in 1808, with a fortune of £30,000 or £40,000. He spent some years in travel and study, and published a blank-verse translation of Dante's *Inferno* in 1812. By purchase he entered the House of Commons in 1812 as Tory member of Parliament for the Borough of Weymouth and Melcombe Regis. In 1818 he was elected for the Aberdeen district of burghs, comprehending his native town of Montrose. In 1830 he had gained such distinction as a radical reformer that he was returned unopposed as one of the members for Middlesex, which he represented until 1837. In 1842 he was again chosen for his native burgh, Montrose, and remained until his death in the service of his fellow-townsmen. As leader of the Radical Party in the House of Commons, he usually found himself in active conflict with both Whig and Tory governments, and at first was treated with contemptuous tolerance. He discovered the widespread conspiracy of the Orange lodges to make the Duke of Cumberland King at William IV.'s death, and a tardy but sincere homage was paid to his integrity and public services by Sir Robert Peel and other political opponents. He held various public offices, was a prominent member and leader of several notable societies, and was twice elected lord rector of Aberdeen University. He died February 20, 1855.

HUME, MARTIN ANDREW SHARP (1847—). An English soldier and historian, long a resident of Spain. He was born in London, but was educated at Madrid, was made Knight of the Spanish Order of Isabella the Catholic, in 1868, and editor of the Spanish State Papers in the Public Record Office, London. He had active service with the Turks in 1878-79, and traveled widely in Africa and South America. Besides his *Chronicles of Henry VIII.* (1889), *Courtships of Queen Elizabeth* (1896), and other works on her period, he wrote *Spain, Its Greatness and Decay* (1898); *Modern Spain* (1899); and *A History of the Spanish People* (1901).

HUME, or **HOME**, Sir PATRICK (1641-1724). A Scottish statesman. Born at Polwarth, Berwickshire, he was brought up a strict Presbyterian, and after a term of law study at Paris, he represented his native county in Parliament, where he at once took a foremost place as defender of the Covenanters. He went so far as to bring imprisonment upon himself, and on being freed was suspected of complication in the Rye House Plot, so that he was forced to remain in hiding until he could escape in disguise to the Continent. There he joined the Duke of Argyll, and embarked with him on the unsuccessful expedition to Scotland (1685). Hume became a refugee with a price set upon his head, but he once more escaped abroad, lived at Utrecht under an assumed name, and returned with William of Orange at the Revolution of 1688. With estates restored, he was now a Scottish peer, Lord Polwarth; was made Lord Chancellor in 1696, and Earl of Marchmont in 1697. He strenuously opposed in Parliament the claims of the Old Pretender to the crown, and voted for the union of Scotland with England, though he was not above the suspicion of having received a reward for so doing. Too dogmatic to be popular, he did not hold office in the United Kingdom till the reign of George I., when he was given some minor charges, but shortly retired.

HUMERAL VEIL (Lat. *humerale*, covering for the shoulders, from *humerus*, *umerus*, shoulder; connected with Gk. *ὦμος*, *ōmos*, Goth. *amsa*, Skt. *aṁsa*, shoulder). An oblong veil of silk, either white or of the color prescribed for the day, which is worn over the shoulders by the deacon in the mass, when he holds the paten from the offertory to the *Pater noster*, and by the priest in giving benediction or carrying the Blessed Sacrament in procession.

HU'MERUS (Lat., shoulder). The largest and longest bone of the upper extremity; the bone of the arm proper, extending from the shoulder to the elbow. It is divided anatomically into a shaft and two extremities. The upper extremity is rather the larger, and has a semi-globular head which is partially received into the shallow glenoid cavity of the scapula or shoulder-blade, forming a ball-and-socket joint. Two processes or projections of the shoulder-blade assist the glenoid cavity in completing the cavity or seat of the head of the humerus. There are three ligaments which hold the humerus to the scapula—the capsular, the coraco-humeral, and the glenoid, the relations being somewhat similar to those of the hip-joint (q.v.). The shaft of the humerus is nearly cylindrical in its upper part, but triangularly prismatic below, becoming flattened and broad at the lower extremity, where are placed the two condyles, with their articular surfaces, and the trochlea between them, which form, with the two bones of the forearm, the elbow-joint. (See ARM; SKELETON.) The broad, flat lower extremity has two depressions on the anterior aspect of the bone; one slight one on the outer side called the radial depression, which is for the reception of the anterior border of the head of the radius, when the arm is strongly flexed; the other, called the coronoid depression, for the reception of the coronoid process of the ulna during flexion of the arm. Opposite the latter depression, on the posterior surface of the bone, is a deep triangular depression, called the olecranon fossa, for the reception of the olecranon process of the ulna when the forearm is extended. The humerus forms with the scapula, as above mentioned, a ball-and-socket joint, the shoulder-joint (q.v.). The elbow-joint is a hinge joint, and, to a certain extent, in its relation to the head of the radius, a ball-and-socket joint.

HUMFREY, HUMPHREY, or HUMPHRYS, PELHAM (1647-74). A famous English musician, and one of the founders of modern English music. He was born in London. He was one of the children of the Chapel Royal, and while yet a boy composed considerable Church music, and in a book of *Divine Services and Anthems*, published by Clifford in 1664, there are five anthems ascribed to him. Upon the breaking of his voice he was sent by Charles II. to France for instruction under Lully. The King was so impressed with the genius of the boy Humfrey that he caused him to be supplied with £200 from the secret-service money, to pay the expense of his journey, and in the two years following (1665-66) sent him £100 and £150, respectively. Upon his return in 1667, he was appointed to the Chapel Royal, where the music he had brought back with him was greatly admired. He had become very skillful in the art of scoring, which, added to his own genius, enabled him to compose anthems which have remained ever since models of beauty in expression, and strikingly apt in the artistic blending of words and music. He was appointed Gentleman of the Chapel Royal (1666) during his absence in France; became Master of the Children in 1672, Composer in Ordinary for the Violins to His Majesty in 1673, and wrote many pieces for the King's band, an organization modeled after "Les Petits Violons" of Louis XIV. His compositions are still in use (many of them still in manuscript) in all the cathedrals and churches of England and America. They are remarkable for their expression and depth of sentiment, as well as for discoveries and departures in harmony; for instance: the sharp fifth, as a passing note, the major third and minor sixth on a bass note, a sequence of imperfect fifth and the augmented or extreme sharp sixth, and the flat third and sharp fourth, combinations new to church music, were utilized by him for the first time. It is supposed from the fact that he frequently indulged in extreme keys, such as C minor and F minor, that his violinists did not use fretted finger-boards, but tempered their scales at will. He died at Windsor and was buried in the cloisters of Westminster Abbey near the southeast door.

HUMIDITY (from Lat. *humiditas*, moisture, from *humidus, umidus*, moist, from *humere, umere*, to be moist; connected ultimately with Gk. ὑγρός, *hygros*, Icel. *vökr*, moist), ATMOSPHERIC. The moisture or aqueous vapor in the atmosphere. This vapor is really an invisible gas, and is the most important component of the atmosphere as to quantity next after nitrogen and oxygen. When this invisible vapor becomes visible it is called dew, fog, mist, haze, cloud, rain, hail, snow, frostwork, or frost, according to the size of the drops of water or the method in which the vapor condenses. Water and ice are not included under the term 'atmospheric humidity,' that term being strictly confined to the invisible vapor.

The aqueous vapor in the air is perpetually falling to the earth as rain or snow, and is renewed by evaporation from the ocean, the lakes and rivers, and the soil itself. The quantity of aqueous vapor in a cubic foot of air varies greatly with temperature and locality on the earth's surface. Thus in the air of Arizona and New Mexico there is oftentimes only from 3 to 10 per cent. of the amount that could be held in case the air was saturated. The quantity that can be held in a saturated space varies greatly with the temperature, but does not depend upon the barometric pressure, and is also quite independent of the presence of air in that same space, since the aqueous vapor and the dry air co-exist side by side. The elastic pressure of the dry air and the elastic pressure of the aqueous vapor added together produce what is ordinarily called barometric or atmospheric pressure. The weight of the moisture and the weight of the dry air added together determine the density of a cubic foot of atmosphere at any time. When a cubic foot of space contains as much aqueous vapor as it can possibly hold at any given temperature, it is said to be saturated with moisture. The following table shows that there may be as much in an extreme case as twenty grains of invisible aqueous vapor in a cubic foot if the space is saturated at the temperature of 100° F., and this vapor will exert an elastic pressure of about one pound to the square inch, such as would be counterbalanced by a column of mercury of about 1.9 inches of the barometer. If, now, dry air is added to this cubic foot of space until a pressure of thirty inches is exerted in all directions, then the weight of the dry air at a temperature of 100° F. will be 465 grains per cubic foot, and the combined weight of the vapor and the air, or the so-called saturated air, will be 485 grains. The following table gives these relations for saturation at a pressure of thirty inches and for temperatures between zero and a hundred, computed according to the data adopted in the Psychrometric Tables of Prof. C. F. Marvin (United States Weather Bureau, 1900):

PRESSURE AND WEIGHT OF VAPOR AND AIR IN A CUBIC FOOT OF ATMOSPHERE AT A PRESSURE OF 30 INCHES WHEN SATURATED AT THE RESPECTIVE TEMPERATURES

TEMPERATURE	Vapor pressure	Dry air pressure	Vapor weight	Dry air weight	Total weight saturated air
DEGREES FAHR.	Inches	Inches	Grs. per cu. ft.	Grs. per cu. ft.	Grs. per cu. ft.
0	0.038	29.962	0.48	605.32	605.80
10	0.063	29.937	0.78	591.93	592.71
20	0.103	29.897	1.24	578.79	580.03
30	0.164	29.836	1.94	565.79	567.73
40	0.247	29.753	2.85	552.89	555.74
50	0.360	29.640	4.08	539.93	544.01
60	0.517	29.483	5.74	526.75	532.49
70	0.732	29.268	7.98	513.00	520.98
80	1.022	28.978	10.93	498.48	509.41
90	1.408	28.592	14.79	482.65	497.64
100	1.916	28.084	19.77	465.77	485.54

This table shows that the capacity of the unit volume of space or air for aqueous vapor increases very rapidly with rising temperature. When the space is not saturated, the atmosphere is said to have a relative humidity expressed as a given percentage of complete saturation. Thus if the air has a temperature of 100 degrees and contains only 10 grains of vapor per cubic foot, it contains only 50 per cent. of the maximum amount possible at that temperature.

The humidity of the atmosphere is usually determined by either the dew-point apparatus or the psychrometric apparatus. In the former the air is cooled down without altering the quantity of moisture that it contains, and the temperature at which that moisture saturates the air is determined. This dew-point temperature is always lower than the temperature of the free air. In the psychrometric method the temperature of a thin layer of water that is evaporating under standard conditions in the open atmosphere is determined. From this temperature of evaporation the psychrometric formula gives us the vapor-tension, the temperature of the dew-point, and the quantity of moisture in the air. In general the temperature of the dew-point is about as far below the temperature of evaporation as the latter is below the temperature of the air.

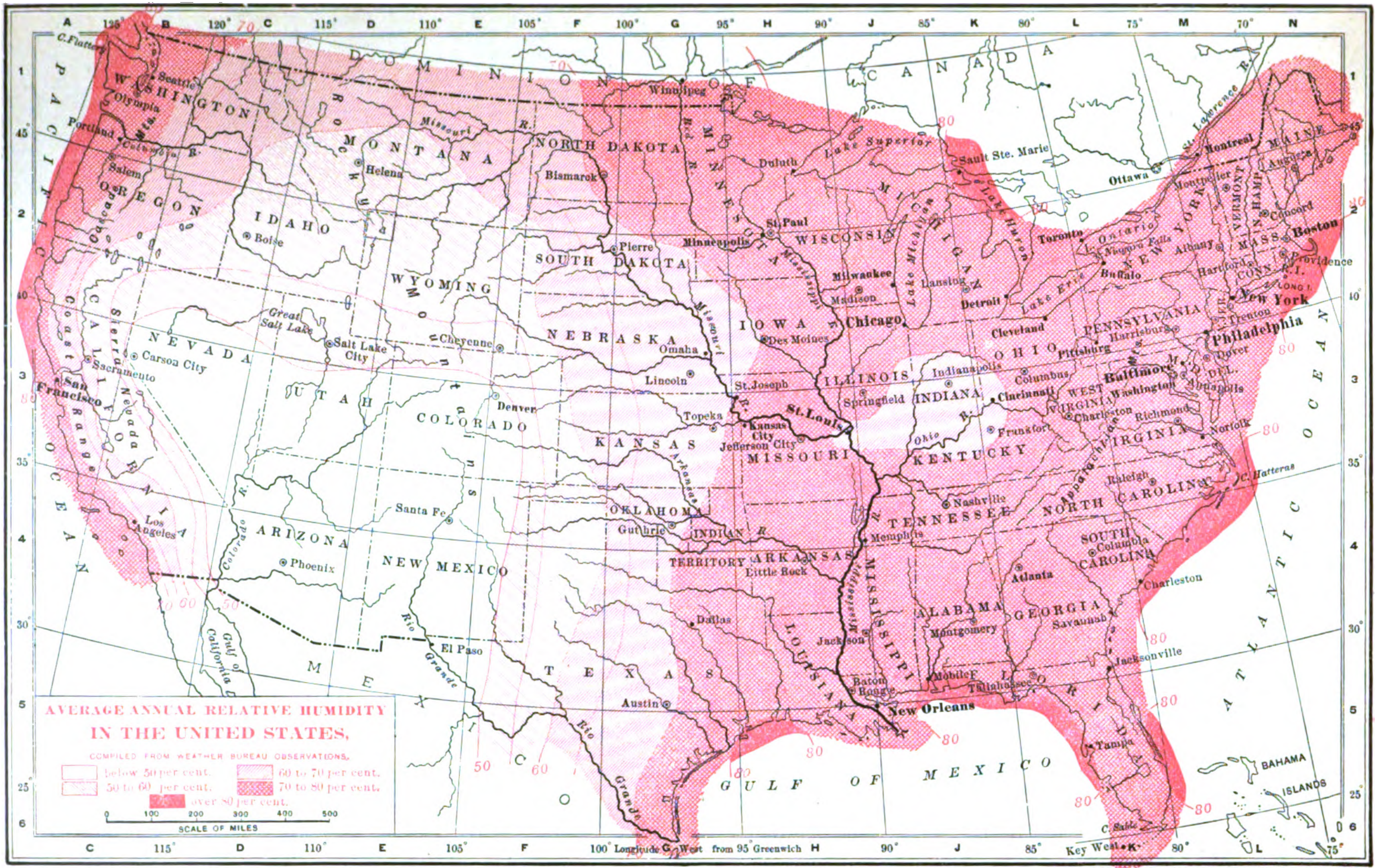
The rate of evaporation from a moist surface diminishes with increasing humidity of the air, so that the total evaporation under a given wind in any given unit of time indicates the average dryness of the air during that time.

Nearly all animal and vegetable substances, by reason of their cellular structure, absorb moisture from moist air, but give it up to very dry air. They are, therefore, perpetually expanding and contracting, curling and uncurling, and their changes may be utilized in the construction of hygrometers. When moist air cools by radiation at night to temperatures below the dew-point, the vapor is precipitated, forming cloud, mist, fog, or dew. On the other hand, when air rises, thereby coming under less pressure, it expands, does work, and is cooled dynamically by reason of the work done. Ordinary air cools at the rate of one degree Fahrenheit for 183 feet of ascent. In this way air that is forced over a mountain may be cooled below the dew-point and form cloud or rain. The moisture in ordinary dry air is easily absorbed by many substances, such as sugar, flour, salt, and in very moist weather objects may become so damp that fungus germs floating in the air and settling on them take root and cover them with mold, or set up fermentation within them.

The humidity of the atmosphere, although invisible, has a special and strong influence in absorbing radiant energy, whether from the sun or from the earth. It therefore converts the dry air into a powerful obstructor to the passage of radiant heat, and by this means the humid atmosphere is made to act as a blanket, keeping the earth and the lower air much warmer than it would otherwise be. See HYGROMETER.

HUMIL'IA'TI (Lat. nom. pl., humbled). A monastic Order, which originated in the eleventh or twelfth century, and was confirmed by Innocent III. in 1201. In the sixteenth century it had 94 houses, with about 170 monks, in Italy, but as it was corrupt, Carlo Borromeo (q.v.) tried to reform it. This attempt led to a murderous assault on him, so Pius V. in 1571 suppressed the Order. Several of their houses were turned over to the Barnabites.—A female Order of Benedictines, known as humiliate nuns, or nuns of Blassoni, from their founder, Clara Blassoni of Milan, served as nurses, etc. The Order still exists in Italy, with four houses.

HUMMEL, hum'mel, JOHANN NEPOMUK (1778-1837). A distinguished Austrian pianist and composer, born at Pressburg and educated primarily by his father, who was a music-teacher. When but eight years of age he accompanied his father to Vienna on the appointment of the latter as kapellmeister of Schikaneder's Theatre. Here he came under the notice of Mozart, who became so interested in the boy that he admitted him to his own family and instructed him for two years. His début in 1787 was also under the auspices of Mozart. Next followed a number of very successful tours through Germany, Denmark, England, and Holland. Probably no other musician in the entire history of music had so distinguished a number of teachers and patrons as Hummel. Beginning with Mozart, his next teacher was Clementi, with whom he studied in London during 1791, followed by a course of study in composition under Albrechtsberger in Vienna (1793), while at the same time he was studying with Salieri in dramatic writing, and receiving much indirect, but nevertheless profit-



AVERAGE ANNUAL RELATIVE HUMIDITY IN THE UNITED STATES,

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able, advice and instruction from the great Haydn. His entire career was marked by success and the appreciation of the public; so much so that at one time he was considered to rival Beethoven. His principal appointments were as follows: From 1804 to 1811, deputy kapellmeister under Haydn in the service of Prince Eszterházy; 1811-16, a successful teacher of composition in Vienna; kapellmeister to the Court of Stuttgart 1816-19, when he resigned to take a similar position at Weimar. None of these appointments interfered with his concert activities, for during his many leaves of absence he appeared in Saint Petersburg (1822), in Paris (1825), Belgium and Holland (1826), Vienna (1827), Warsaw (1828), and made a return visit to France in 1829. He appeared in London, and was for a season the musical director of German opera at the King's Theatre. From this time on his health gradually failed, and after much suffering he died at Weimar. He was a Chevalier of the Legion of Honor, and during his lifetime received many tokens of princely favor. As a pianist he ranked with the most famous of his generation, and as a composer was of scarcely less excellence. His compositions number over a hundred, and include operas, cantatas, ballets, and considerable chamber music. For the Church, he wrote three masses arranged for four voices with orchestral and organ accompaniment, which are still held in high esteem. His Graduale and Offertorium are in use to-day throughout Austria and Hungary. At least six of his concertos and a few of his sonatas remain standard works, and are in constant demand. He is of importance in the history of music, if only because of his efforts to introduce the present method of fingering in pianoforte study.

HUMMEL, Karl (1821—). A German landscape painter and engraver, son of the composer, Johann Nepomuk Hummel. He was born at Weimar, studied engraving under Schwerdgeburth and painting under Preller, with whom he traveled through Europe. From an earlier and idealized manner, after the fashion of Preller or of Claude Lorraine, Hummel gradually approached a more natural treatment, and turned in this second period from Italian scenery to landscapes nearer home. Among his pictures, of which many belong to the Grand Duke of Weimar, are: "The Gardens of Armida," which is his most important work (1858); "View of Brienz Lake" (1858), and "View in Lauterbrunn Valley" (1859), both in the Leipzig Museum; "Cività Castellana" (1879); "Monte Coracte;" "Keller Lake in Holstein" (1884); and a "Wooded Landscape Near Michaelstein" (1888). His engravings of landscapes are also well known. Hummel became professor in the Weimar Academy of Art in 1859.

HUMMELER (from *hummel*, variant of *humble, hamble*, to mutilate, from AS. *hamelian*, OHG. *hamalôn*, to maim, Ger. *hammeln, hämmeln*, to geld, from OHG. *hamal, ham*, mutilated; possibly connected with Skt. *śam*, to injure). A hand implement or machine used especially in Scotland, for removing the awn from the grain of barley after it has been thrashed. A common kind of hummeler is a set of blunt knives fixed in a frame, with a handle, by means of which the machine is operated. Another form consists of blunt knives set on a roller. Hummelers of various construction are sometimes attached to threshing-machines, in all of which blunt knives are made to pass frequently through the grain.

HUMMING-BIRD (so called from the sound of its whirring wings). One of the diminutive birds of the picarian family Trochilidæ, closely related to the swifts. More than 400 species are known, exclusively American, and mainly confined to the tropics, though a few species are summer visitors to colder latitudes, as far even as 61° N. A few, also, of the tropical species inhabit elevated mountainous tracts, even to the confines of perpetual snow. In the United States eighteen species of humming-birds are known, but only one of these is found east of the Mississippi and north of Florida. All of the others belong to the Southwestern States and the Pacific Coast (see following page).

Characteristics. The brilliancy of humming-birds, the rapidity with which they dart through the air, their hovering above the flowers from which they obtain their food, with a humming sound of wings which move so quickly as to be indistinctly visible, or 'like a mist,' have attracted universal admiration. The diminutive size of almost all of them—some are the smallest of birds, and when stripped of their feathers not larger than a bumblebee—has still further contributed to render them objects of interest. Like the bumblebees, too, they perform a service in the cross-fertilization of flowers. Consult Belt, *Naturalist in Nicaragua* (London, 1888).

The largest known species is *Patagona gigas* of the Andes, which reaches a length of 8½ inches, but this is really gigantic, few species exceeding 6 inches. The smallest known species is *Calypte Helenæ*, which is only 2¼ inches long; it is a native of Cuba.

The plumage of the different species exhibits an almost endless variety of form as well as of color, in crests, neck-tufts, leg-tufts, and many an extraordinary development of tail. The plumage of the males is usually far more varied and glittering than that of the females, and this tribe furnishes an extensive and forcible example in support of the doctrine of sexual selection (q.v.). The metallic brilliance of the plumage, which in the gorgets and elsewhere often exhibits a gem-like coruscation and iridescence, is due to the interference of light by the minute scales upon the surface of each feather, and not to pigments. The young resemble their mothers until they reach maturity.

Food, etc. Humming-birds have slender bills, which are also generally long, and in some extremely so, the form of the bill exhibiting adaptation to the kind of flowers from which the bird obtains its food—straight in some, curved in others. The bill of the 'swordbill' (*Docimastes ensiferus*) is 5 inches long, much longer than the head, body, and tail of the bird together, while in *Rhamphomicron microrhynchum* the bill is only ¼ of an inch long. In the sickle-billed humming-birds (see Hermit Humming-Bird) the bill is notably curved so as to form almost one-third of a circle, while in Avocettula it is sharply and abruptly recurved at the tip. Humming-birds do not, as was long supposed, feed on honey alone, but to a considerable extent, and some of them perhaps chiefly, on insects, not excepting spiders, while they often snatch away the insects which have become entangled in spiders' webs. The lower mandible fits into the upper, and the bill is thus adapted as a tube for sucking, in which, as well as in seizing small insects within the recesses of flowers, the tongue is also a very efficient organ. The tongue is very long, capable of being darted out to a considerable length; the bone of the tongue is much elongated, and its branches pass round the back of the skull to the forehead, where they meet in a point before the line of the eyes. The tongue itself consists of two filaments, joined together for the greater part of their length, and separated at the tip. The wings of humming-birds are very long and powerful, the first quill-feather the longest, and the rest shorter in succession.

NESTS, ETC. These diminutive birds construct exquisite nests of shreds of bark, soft grass, or cottony substances. They are placed in a great variety of situations, from a mere saddling upon a branch to an attachment to the tip of a pendent and swaying leaf or tendril; and often the exterior is made almost invisible by having a coating of lichens or something else allying it closely to its background. The eggs are invariably two in number, and they are always plain white. The tiny owners are very bold in defense of their nests and young, and are said to strike fearlessly with their needle-like bills at the eyes of birds of prey, which they far surpass in agility and rapidity of flight. They are very easily, however, imbued with confidence in a person with whom they are familiar, and have been known to return again in spring, after a winter migration to a warmer climate, to the window from which they had been allowed to escape. Attempts to keep them in confinement have generally failed, and few have ever been carried alive across the Atlantic. Most of the hummers have no song, their only notes being querulous squeaks of wrath or fear. A few of the tropical forms, nevertheless, are said to be slightly musical. The skins of humming-birds were employed for ornamental purposes by the more civilized American races before the discovery of America by Europeans, and were used by the Mexicans for making the pictures which excited the admiration of their Spanish conquerors.

EXAMPLES. Within the present space limits it will not be possible to give any adequate description of the various species of humming-birds, and this article must be confined to mention of the forms illustrated herewith, and to a brief account of the better-known species of the United States. The helmet-crests (Oxypogon) are Andean, and owe their name to their high-pointed head ornaments. The coquettes (Lophornis) are small, much ornamented hummers of the Amazon region, and are easily recognized by their fan-like crests, and by the spangled frills on each side of the neck. They are numerous and well scattered in South America, where one of the most beautiful is the 'tufted' coquette of the island of Trinidad and the adjacent mainland. The racket-tailed hummer (Steganura), whose home is a limited region near the head of the Amazon, is among the smallest and most extraordinary of these birds; and is described as crossing, recrossing, and 'snapping' in a marvelous way its long tail-feathers in the air, as it darts about, especially when a rival male is near. The long-tailed species of the genus Aithurus are West Indian; the one figured is a denizen of Jamaica.

RUBYTHROAT, ETC. Of the several humming-birds of the United States, the ruby-throated (*Trochilus colubris*), is most widespread and familiar. It extends far to the north in summer, and may be found breeding from Florida to Hudson Bay. In winter it retires to subtropical regions, and is found from southern Florida to Central America. It is less than·4 inches long, and the principal color is bright shining green. The throat of the male is a beautiful metallic ruby-red. This exquisite bird arrives in the Northern United States early in May, with the opening of the cherry-blossoms, and goes south late in August or early in September. In the Rocky Mountain region of the United States the rubythroat is replaced by the broad-tailed hummer (*Selasphorus platycercus*), a somewhat larger bronze-green bird with rose-purple throat. On the Pacific Coast the common hummer is the Nootka Sound or rufous humming-bird (*Selasphorus rufus*), about the size of the rubythroat, but deep rufous above, with the throat brilliant scarlet. It is notable for its occurrence as far north as Nootka Sound, Alaska, but it winters in Mexico. The commonest species in California, where it is resident through the year, is Anna's humming-bird (*Calypte Anna*), a trifle smaller than the rubythroat, and of more exquisite coloration. The male is bronze-green above, with the whole head and throat brilliant purplish or rose-red.

BIBLIOGRAPHY. The literature devoted to humming-birds is very extensive, including several hundred titles, but the most important works are: Gould, *Monograph of the Trochilidæ* (London, 1861), and Elliot, *Synopsis and Classification of the Trochilidæ* (Washington, 1879), while to the American reader, Ridgway, "The Humming Birds" (*Annual Report of the Smithsonian Institution* for 1890, Washington, 1892), is by far the best popular work. See HELMET-CREST; HERMIT HUMMING-BIRD; HILL-STAR; SUN-BIRD.

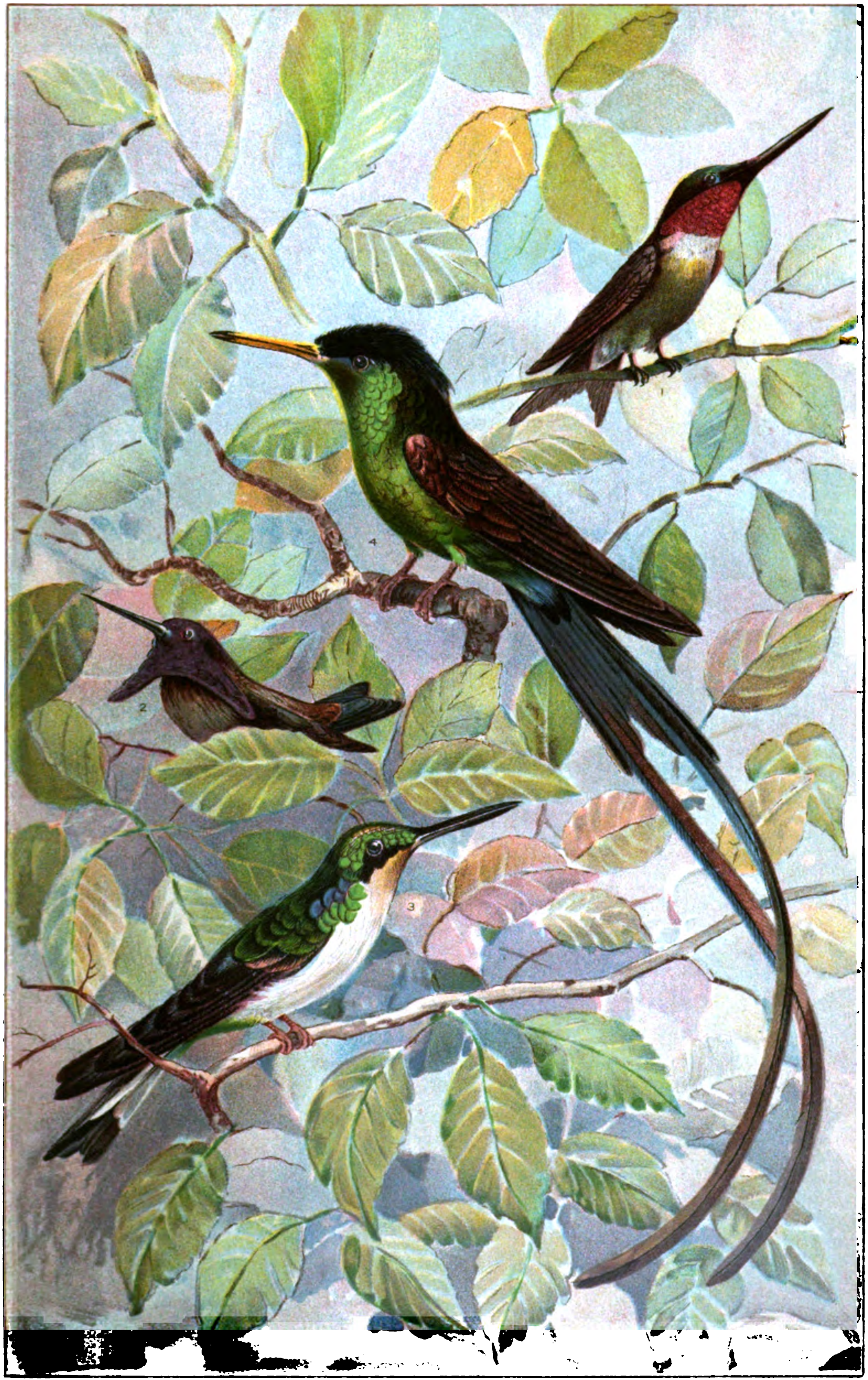
HUMORESKE, hụ'mṓ-rĕs'ke (Ger., Dan., from *humor*, Lat. *humor*, humor, disposition, from *humere*, to be moist). Originally a short, humorous tale or sketch, but applied by Schumann to short compositions for the pianoforte in a rather free form, and distinguished by originality in harmonic and rhythmic combinations.

HUMORS. See HIPPOCRATES; MEDICINE.

HUMPBACK. A rorqual (family Balænopteridæ) or whalebone whale of the genus Megaptera. in which the dorsal fin forms a lump upon the back. It is found in all seas, often reaches a length of 50 feet, and sometimes much more; is thick and ungainly, and yields fifty or more barrels of oil. The baleen is short and of poor quality. This whale (*Megaptera longimana*) is recognizable at a long distance by its lolling, irregular manner of swimming, and at the mating season pairs indulge in antics highly amusing because of their size and uncouthness. They strike each other with their long flippers, and these love-pat caresses may be heard miles away. It is believed that in these performances originated the stories current about the attack of the whale by the thresher shark, which, as a matter of fact, could not injure such an opponent. See RORQUAL; WHALE.

HUMPBACKED SALMON. One of the smallest and poorest of the Pacific salmon (*Oncorhynchus gorbuscha*). It weighs only

HUMMING-BIRDS



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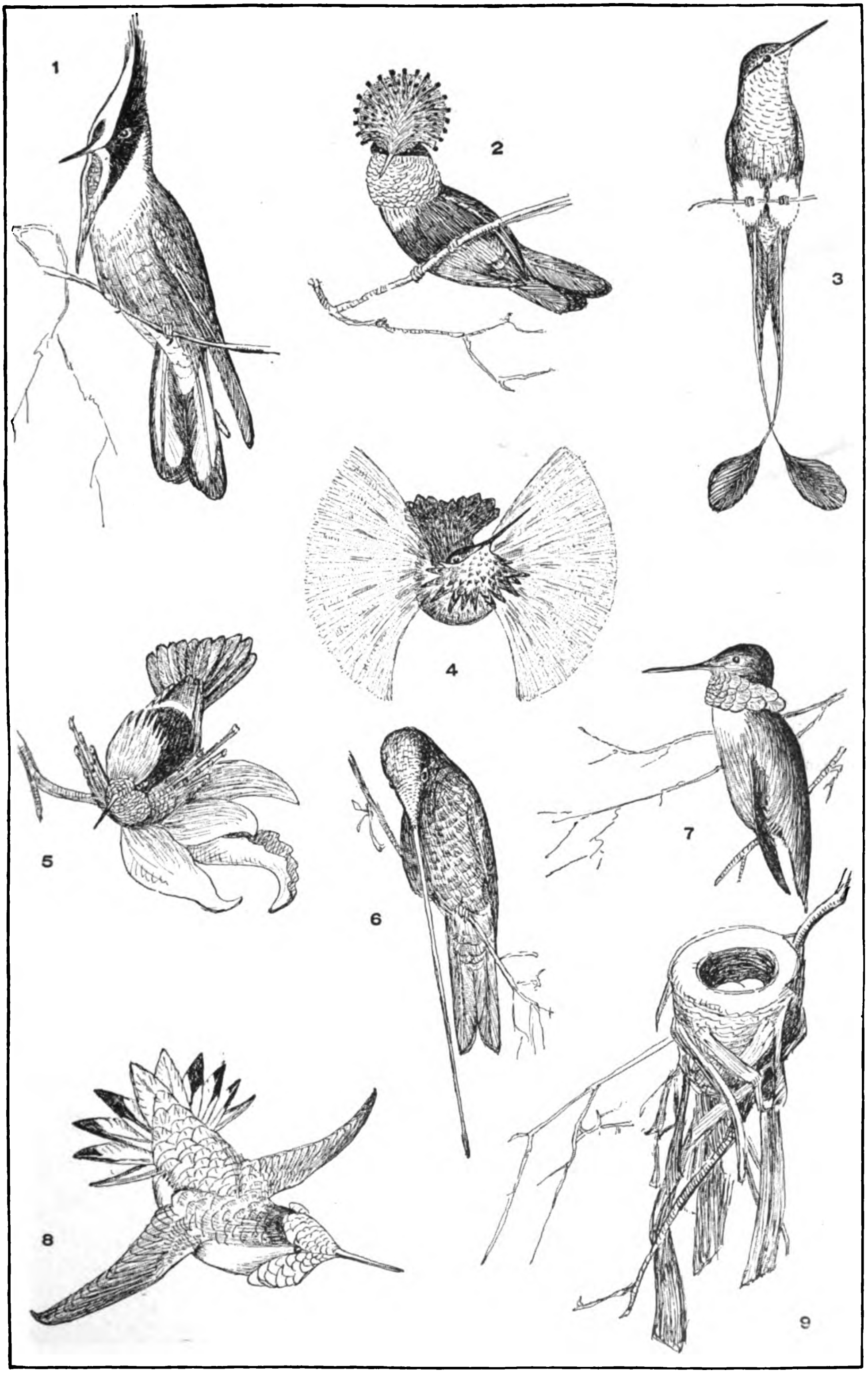
1 RUBY THROATED HUMMING-BIRD
TROCHILUS COLUBRIS
2 CALLIOPE HUMMING-BIRD – STELLULA CALLIOPE
3 GOLDEN HUMMER – HELIOTHRIX AURITUS
4 LONG-TAILED HUMMING-BIRD
AITHURUS POLYTMUS

NATURAL SIZE

HUMMING-BIRDS



1. **HELMET-CREST** (Oxypogon Guerini).
2. **SPANGLED COQUETTE** (Lophornis reginæ).
3. **RACKET-TAIL** (Steganura Underwoodi).
4. **CALLIOPE HUMMER** (Stellula calliope).
5. **TUFTED COQUETTE** (Lophornis ornatus).
6. **SWORDBILL** (Docimastes ensiferus).
7. **RUFOUS HUMMER** (Selasphorus rufus).
8. **FLORESIS HUMMER** (Selasphorus floresii).
9. **NEST OF RED-THROATED SAPPHIRE** (Hylocharis sapphirina).

three to six pounds, and is distinguishable by the small size of the scales and by the oblong coarse markings on the tail. It is occasionally seen in California and in the Columbia River, but is common from Puget Sound northward, where it is the 'dog-salmon' or 'gorbuscha' of Alaska; also called 'haddo' and 'hay-ko' by the Indians, who smoke-dry it, and use it as winter food. See Salmon; and Plate of Salmon.

The term humpbacked is applied to other fishes, having an elevated dorsal outline, especially an Alaskan whitefish (*Coregonus Nelsoni*).

HUMPED CATTLE, or Zebu. The common domestic cattle of India and the East, known in books as 'zebu' or 'zubr,' but not so called anywhere in the Orient. It seems to be a distinct species (*Bos Indicus*), of which no wild examples remain. Certain bands of these cattle running wild have, however, ranged the forests of Eastern India for hundreds of years, and are large, long-horned, and shy. In addition to the enormous hump on the fore shoulders, these cattle show some convexity of the forehead, concavity of the upper border of the short horns, large drooping ears, and a very large dewlap. In size and color they vary considerably. The most common colors are ashy gray or creamy buff, but red, brown, black, and even white ones are seen. A certain number of white bulls are held sacred by the Hindus, whence the name 'Brahminy,' often given to the entire race; and these wander about, devastating crops and feeding upon the vegetables exposed for sale in the bazaars without serious interference. The humped cattle are diffused over India, China, the Asiatic islands, Madagascar, and the east coast of Africa. There are many breeds, differing much in size; the largest are greater than any oxen of Europe, while the smallest are not much bigger than a large mastiff. The hump of the largest breeds is said to be sometimes 50 pounds in weight. English residents in India esteem the hump as delicious for the table. There are hornless breeds, and a breed with two fatty humps, one behind the other, is common in the vicinity of Surat. The voice resembles the grunting of the yak, almost as nearly as the lowing of the ox. The zebu is used in India both as a beast of draught and of burden, is yoked in the plow, is occasionally used for riding, and can travel from twenty to thirty miles a day, and is very gentle and docile. In recent years they have been introduced into Jamaica in considerable numbers, and are used on the large banana estates.

Galla Ox, or Sunga. A breed of humped cattle domesticated in East Africa, and most common in Abyssinia, remarkable for its massive horns, which sometimes form the figure of an upright lyre above its head. A sunga's horn may be 46 inches long, and 15 inches around the base. This variety was known in ancient Egypt, and has been regarded as the parent stock of the Indian breeds of humped cattle; while Blyth finds in it an affinity to the banteng. Consult *Proceedings of the Zoölogical Society of London* (London, 1898).

HUMPERDINCK, hụm'pĕr-dĭŋk, Engelbert (1854—). A German composer, critic, and teacher, born in Siegburg, near Bonn. He was studying to become an architect at Cologne, when he came under the influence of Hiller (q.v.), and was persuaded to devote himself to music. Few of his native contemporaries have been more fortunate or successful in securing recognition for their work and talents. At the age of twenty-six he was an intimate friend of the Wagner family at Bayreuth, and for the two or three years immediately preceding the great master's death was his especial protégé; besides which he was the instructor of Siegfried Wagner, and was selected because of his intimate knowledge of the composer's ideas, to write the pianoforte arrangements of Wagner's music dramas, and to assist in the preparation of *Parsifal* for the public stage. He is better known throughout Europe generally, and America in particular, for his opera *Hänsel und Gretel* (1893)), which gained for him a world-wide reputation. In 1902 an English dramatic version of *Die Königskinder* (1896) was given in England and America under the title of *The Children of the King*, in which was retained the incidental music of the original German version. Humperdinck was educated largely at the Cologne Conservatory. He won the Mendelssohn prize in 1878, and the Meyerbeer prize in 1880. His principal teaching appointments were at the Barcelona (Spain) Conservatory (1885-86); Cologne (1887-88); Frankfort, in which city he won the Mozart scholarship and also acted as concertmaster at the opera (1890-96). Other important compositions in addition to those already mentioned are: *Dornröschen* (1895); *Die sieben Geislein*, a children's fairy story (1896); *Symphony in C* (1896); and incidental music to *Der Richter von Zalamea* (1896). During his stay in Frankfort he served as musical critic on the staff of the *Frankfurter Zeitung*, from which he retired in 1896, when he took up his residence at Boppard. His manner is somewhat Wagnerian, but his music is nevertheless strikingly original and pure. He is particularly happy in his musical treatment of folk-lore and fairy tales. In 1900 he was called to Berlin as member of the Academy of Fine Arts and teacher of composition.

HUM'PHREY, Heman (1779-1861). An American Congregational clergyman and educator. He was born in Connecticut; graduated at Yale in 1805, and was pastor of the Congregational church in Fairfield, Conn., from 1807 to 1817, and of that in Pittsfield, Mass., from 1817 to 1823. He was president of Amherst College from 1823 to 1845, during the infancy of that institution. He was an early advocate of temperance, and a report of his on the subject made in 1813 is said to have been the first temperance tract. Among his publications there are, besides biographies, *The Sabbath* (1830); *Tour in France, Great Britain, and Belgium* (1838); and *Domestic Education* (1840). Consult: Z. M. Humphrey and Neill, *Memorial Sketches of Heman and Sophia Humphrey;* and Tyler, *History of Amherst College* (Springfield, 1873).

HUMPHREY, The Good Duke (1391-1447). Duke of Gloucester and youngest son of Henry IV. He was Regent of England under Henry V. and Protector previous to the coronation of Henry VI. He married Jacqueline, heiress of Holland and Hainault, and in 1424 overran Hainault, which was recovered by the Duke of Brabant. Later he married Eleanor Cobham, who was imprisoned for life for treason, and at the time of his death Humphrey himself was under similar charge.

HUMPHREY CLINKER, The Expedition of. A novel in the form of letters, by Tobias

Smollett. It narrates the fortunes of the title character, a postilion, after he enters the service of the Brambles. He proves to be his master's natural son, and marries his mistress's maid, Winifred. The work was published in 1771, and founded partly on Anstey's *New Bath Guide*, and partly on the author's own life. Tabitha and Winifred are obviously the literary ancestors of Sheridan's Mrs. Malaprop; while Scott admits copying the pedantic Lismahago in his Sir Dugald Dalgetty.

HUM'PHREYS, ALEXANDER CROMBIE (1851—). An American gas-engineer and educator, born in Edinburgh, Scotland. Having come to the United States in 1859, from 1866 to 1872 he was a member of the staff of a New York insurance company; in 1872 was appointed secretary of a Greenville (N. J.) gas-light company, and shortly afterwards its superintendent. In 1877-81 he studied at the Stevens Institute of Technology (Hoboken, N. J.); from 1881 to 1885 was chief engineer of a lighting company of New York, and in 1885 was appointed superintendent of construction of a gas improvement company, of which he became general superintendent, and ultimately commercial manager, with headquarters at Philadelphia, Pa. He entered a London gas company in 1892, and in 1894 established a branch of the company in New York. During his connection with these various enterprises he greatly furthered the manufacture of water-gas. In 1902 he was elected president of Stevens Institute to succeed Henry Morton, deceased.

HUM'PHREYS, ANDREW ATKINSON (1810-83). An American soldier. He was born in Philadelphia; graduated at West Point in 1831, and was assigned to the artillery. He resigned in September, 1836, and for the next two years was a civil engineer employed on Government work under Major Hartman Bache. In July, 1838, he reëntered the army as first lieutenant, and was assigned to the corps of topographical engineers. From 1842 to 1849 he was assistant in charge of the Coast Survey office. Later he was engaged in the surveys of the delta of the Mississippi, and in those for various railroads. Soon after the outbreak of the Civil War he became a member of the staff of General McClellan, with the rank of major, and in the Peninsula campaign was chief topographical engineer of the Army of the Potomac. In April, 1862, he was promoted to be brigadier-general of volunteers, and he was afterwards in command of a division in the Fifth Corps of the Army of the Potomac, participating in the battles of Fredericksburg and Chancellorsville. In the battle of Gettysburg he commanded the Second Division of the Third Corps, and as such had an active share in the second day's fighting, earning promotion to a major-generalship in the volunteer service. From July 8, 1863, to November, 1864, he was chief of staff to General Meade, and subsequently commanded the Second Corps of the Army of the Potomac in Grant's final campaign against Lee. He was brevetted major-general in the Regular Army for services at Sailor's Creek, commanded the District of Pennsylvania for a time, and after being mustered out of the volunteer service was placed in command of the engineer corps with the regular rank of brigadier-general. He was retired from active service in 1879. He published: *The Virginia Campaigns of 1864 and 1865* (1882); *From Gettysburg to the Rapidan* (1882); and, with H. L. Abbott, a *Report on the Physics and Hydraulics of the Mississippi River* (1861).

HUMPHREYS, DAVID (1752-1818). An American soldier, diplomat, and poet, born in Derby, Conn., and educated at Yale College. At the outbreak of the Revolutionary War he entered the army as captain, became major of a brigade under General Parsons in 1777, was made aide to General Putnam in 1778, and in 1780 became Washington's aide and military secretary. After the battle of Yorktown he was put in charge of the colors and standards captured from the British troops, and for his services received from General Knox, in 1786, a sword voted by Congress five years before. In 1784 he acted as secretary of the commission, consisting of Adams, Jefferson, Franklin, and others, that went to Paris to arrange commercial treaties between foreign powers and the United States. He served in the Connecticut Legislature in 1786, participated in the suppression of Shays's Rebellion in 1787, and from 1788 to 1790 lived with Washington's family at Mount Vernon, where he wrote *An Essay Upon the Life of Gen. Israel Putnam.* From 1791 to 1797 he served as United States Minister in Lisbon, being the first diplomatic representative of the United States ever sent to Portugal; and was then made Minister Plenipotentiary to Spain. In 1802 he returned, bringing with him the first merino sheep introduced into the United States. During the War of 1812 he commanded the Connecticut militia. He was a fellow of the Royal Society of London, and a prominent member of the literary coterie known as the 'Hartford Wits,' with whom he wrote the *Anarchiad.* His other writings include: *The Widow of Malabar,* a translation of the French tragedy; *An Address to the Armies of the United States* (1782); *The Happiness of America; The Future Glory of the United States;* and many political papers and orations.

HUMPHREYS, HENRY VOEL (1810-79). An English author, illustrator, and naturalist, born in Birmingham. Much of his early life was spent in Italy. He provided the illustrations for Westwood's *British Butterflies* (1841), and for Loudon's *British Wild Flowers* (1856). He was the author of some numismatic handbooks, such as: *The Coins of England* (1846); *Ancient Coins and Medals* (1850); two volumes of illustrations for *Froissart's Chronicles* (1844); *Illuminated Books of the Middle Ages* (1844-49, with Owen Jones); and other works and illustrations.

HUMPHREYS, JOSHUA (1751-1838). An American shipbuilder of Revolutionary time. Welsh by descent, but a native of Haverford, Pa., he learned his trade in Philadelphia, and when it became necessary for the English colonies to have ships of their own with which to fight the mother country, Humphreys was their first builder. From that fact he was called 'the father of the American Navy.' He built such ships as the *Constitution, Chesapeake, Congress, Constellation, President,* and *United States.*

HUMPHREYS, MILTON WYLIE (1844—). An American educator, born in West Virginia. He was educated at Washington and Lee University, and at Leipzig and Berlin, and from 1869 to 1875 was adjunct professor of the ancient languages at Leipzig. Having held the chair of Greek at Vanderbilt University from 1875 to 1883, he was professor of ancient languages at the University of Texas from 1883 to 1887, and in the latter year became professor of Greek at the University of Virginia. In 1882 he was president of the American Philological Association, and for a number of years he was American editor of the *Revue des Revues*. His publications include excellent editions of *The Clouds* of Aristophanes (1885), and the *Antigone* of Sophocles (1891).

HUMUS (Lat., ground). A generic term for the decomposed organic matter contained in soil. During decomposition of vegetable matter the carbon, nitrogen, oxygen, and hydrogen pass off in the form of water, carbon dioxide, ammonia, etc., or are carried down into the earth in solution, while the remainder of the constituents form compounds less easily removed, to which the name humus is properly applied. These compounds have been investigated chemically, but little is known as to their nature and relations; special names have been given to a few of them, as crenic acid, apocrenic acid, ulmic acid, and ulmin. They are of importance in relation to the fertility of the soil, increasing its power of absorbing and retaining water, lessening its tenacity, and causing more rapid absorption of heat from the sun's rays. They may also indirectly afford nutrition to plant life. See SOIL; COMPOST.

HUMUS PLANTS. Plants which grow naturally in humus soil. Ordinarily in nature, where large amounts of humus are found, there is a rich development of forest trees. Associated very intimately with the humus, however, are a number of plants which depend not only upon the rich organic food found in the humus and in the shade furnished by the trees, but also upon the presence of fungi which permeate the humus. The significance of these fungi is discussed under the head MYCORRHIZA. Until recently, the plants dependent upon humus have been called saprophytes, but inasmuch as more close investigation has shown that the dependence is very rarely directly upon the humus, but rather upon the fungi spoken of above, such plants are now referred to as symbiotic saprophytes. Among these are found not only plants destitute of chlorophyll, like the Indian pipe, but also a large number of green plants, even forest trees, such as beech and pine. See FOREST; SAPROPHYTE.

HU-NAN, hōō'nän' (Chin., south of the lake, i.e. the Tung-ting Lake). An inland province of China, bounded on the east by the mountains of Kiang-si, on the south and southwest by the Nan-ling Mountains, which separate it from the provinces of Kwang-tung and Kwang-si, on the west by Kwei-chow and Sze-chuen, and on the north by Hu-peh (Map: China, D 6). Area, about 77,000 square miles. It is made up of the basins of four rivers, which discharge into the Tung-ting Lake and through it into the Yang-tse. The chief of these rivers are the Siang, which rises in the Nan-ling and flows north, receiving many tributary waters in its course; the Tsze; and the Yuen, which has its origin in the southeast of Kwei-chow, the latter furnishing the shortest and most satisfactory route to Kwei-chow, Yun-nan, and Burma, being navigable by native boats as far as Ch'ên-yuan-fu on the Kwei-chow frontier. The general slope of the province is toward the lake. Hills attaining in some places the height of mountains are found in the south, southeast, and along the Kwei-chow border on the west. The soil is fertile, and in many parts two crops a year are produced. The chief agricultural products are tea, rice, hemp, and tobacco. Hu-nan is one of the principal tea-producing regions of China, and immense quantities are shipped every year to foreign countries from Hankow. The coarser varieties are prepared in brick form and sent overland via Hankow to Siberia and Russia. Both bituminous and anthracite coal is found and mined. The anthracite is of good quality and is exported. Iron, copper, and tin are also found. Capital, Ch'ang-sha-fu. The population of Hu-nan is estimated at about 22,000,000. The inhabitants are noted for their lawlessness and their hostility to foreigners.

HUNCAMUNCA, hŭn'kȧ-mŭŋ'kȧ. The ingenuous daughter of King Arthur and Queen Dollallolla in Fielding's burlesque *Tom Thumb the Great*.

HUNCHBACK, THE. The most successful comedy of J. Sheridan Knowles, produced in 1832. At Covent Garden, under Kemble's direction, Fanny Kemble played Julia, and the part of Master Walter was taken by the author himself.

HUNDRED (AS. *hundred*, Ger. *hundert*, from AS., Goth. *hund*, OHG. *hunt*, Ger. *hund*, OIr. *cēt*, Lith. *szimtas*, Lett. *simts*, OChurch Slav. *sŭto*, Lat. *centum*, Gk. *ἑκατόν*, *hekaton*, Skt. *śata*, hundred + AS. *-red;* connected with OHG. *radia*, Ger. *Rede*, account, speech, Goth. *raþjō*, Lat. *ratio*, reckoning, *reri*, to think). An ancient territorial unit in England, less than a shire or county, and usually greater than a parish or town. The origin of the name is involved in obscurity, but it is supposed to be derived from a convenient grouping of one hundred families for purposes of defense, or for local administration. Hundreds varied greatly in size in different parts of England, from two square miles in the southern counties, to three hundred square miles in Lancashire, but they maintained considerable uniformity within the limits of a given county. But they were not mere subdivisions of the county, being both historically and for various administrative purposes independent of the greater territorial division within which they were included. See the article WAPENTAKE.

Each hundred had a court of ancient and forgotten origin, which was known as the *Hundred Court*. This was held at frequent intervals and appears to have been of equal authority with the county courts, though its jurisdiction seems to have been more restricted, being apparently confined to civil causes, such as actions of debt and trespass. Like the other customary courts of the feudal period, such as the county courts, courts baron, and the like, the hundred courts were composed of the freeholders of the hundred, who were liable to do service as 'suitors,' i.e. triers of suits, as one of the obligations of their freehold tenure. Most of these courts have been abolished and their jurisdiction transferred to the county courts, but a few, which were courts of record, have been permitted to survive.

But the hundred was more than a political and administrative unit; it was also a communal unit. It was liable in damages for a false judgment given by the hundred court. As early as the reign of Edgar it was provided that the hundred should be responsible for the administration of justice and liable to punishment by fine or otherwise if thieves and other criminals were not brought to justice. The statute of Winchester in 1285 (13 Edw. I., c. 2) made the hundred liable to respond in damages for robberies committed within its limits if the offender was allowed to escape punishment. At a still earlier period it was subject to the famous murder fine, imposed by the laws of Canute upon any hundred in which any one not an Englishman was found slain. (See ENGLISHERY.) As lately as 1886 the hundred continued to be legally liable for damages resulting from rioting. Consult: Pollock and Maitland, *History of English Law* (2d ed., London and Boston, 1899); Stubbs, *Constitutional History of England* (Oxford, 1880).

HUNDRED DAYS, THE (Fr. *les cent jours*). The term of Napoleon's second reign as French Emperor. The period extended from March 20, 1815, the date of his entry into Paris, to June 28th, when Louis XVIII. once more assumed power. At Elba Napoleon had been kept informed of the dissension prevailing among the Allies at the Congress of Vienna, and of the extreme unpopularity of the restored Bourbons in France. Seizing the opportunity, he left Elba, February 26th, landed with 900 men near Cannes, and called upon the country to rise in his favor, March 1st. The apathy of the Bourbons at Paris allowed Napoleon time to recruit his strength. When Louis at last bestirred himself it was too late. The Napoleonic fever had spread, the soldiers of the Empire rallied around their old leader, and the troops sent out against him joined his standard. The final blow to the monarchy came when Ney, after great hesitation, went over to Napoleon, who entered Paris in triumph March 20th, Louis having fled northward to Ghent. Napoleon immediately organized a government, issued writs for the election of an extraordinary assembly to draft a new constitution, abolished the existing Legislature, and began to raise troops. Meanwhile the Allies at Vienna, on hearing of his landing, pledged themselves to hunt down the 'bandit' and to put it out of his power, once for all, to disturb the peace of Europe. Eight hundred thousand men were sent out against him. At Paris there was a foreboding that this sudden restoration could not last; but though men had lost much of the fear and respect Napoleon had been wont to inspire, the work of organization nevertheless went on actively. On June 1st, in the Champ de Mars, Napoleon solemnly swore to this new Constitution, which was very liberal in character, and then set out with his army, for he had succeeded in raising 287,000 men, for the north. (See LIGNY; QUATRE-BRAS; WATERLOO.) Four days after Waterloo, June 22d, he abdicated in favor of his son, attempted to escape to America, failed, and gave himself up to the English. See FRANCE.

HUNDRED YEARS' WAR, THE. The name of the long series of contests waged by the English kings, between 1337 and 1453, to gain the French crown and French territory. It was by no means an uninterrupted war, but rather a succession of battles, truces, and peaces. The first great period of the war extends from 1337 to 1380. Philip VI. (1328-50), of the House of Valois, had succeeded Charles IV., the last of the direct descendants of Hugh Capet, since, in accordance with the Salic law (q.v.), the crown of France could be transmitted through the male line only, though Edward III. of England was a nearer relation to the late King, his mother, Isabella, being a sister of Charles. Edward's claim, however, was weak in this, that if females could transmit claims to the crown, then there were others who had even better claims than the English King. On June 6, 1330, and May 30, 1331, Edward by letters patent recognized Philip's claims, and had the latter been a more capable man, war might not have resulted. The French King interfered in the affairs of the Flemish cities, with which England had intimate commercial relations. Moreover, Edward was influenced by the exiled Robert of Artois, who had been unable to obtain his inheritance from Philip VI. Edward declared war in 1337, and gradually made alliances with the Emperor Louis IV. and John of Brittany, who was opposed by Charles of Blois, cousin of Philip VI., in his attempts to secure his inheritance. It is this war in Brittany which the great chronicler Froissart (q.v.) has especially described. On the other hand, Philip established that close alliance of France and Scotland which was to endure for centuries. There were many small skirmishes during the first years of the war, but neither side gained decisive victories, and on January 9, 1343, a truce was concluded for three years, each side retaining its possessions. Hostilities, however, were resumed in 1345. At this juncture the alliance of the Flemish cities was lost to England by the death of Jakob van Artevelde (q.v.), the leader of the Flemings, who perished in a popular tumult. On August 26, 1346, the English, under the leadership of Edward himself, won their first great victory at Crécy (q.v.), which showed that the French knights could not stand against the well-disciplined yeoman archers of England. The victors took possession of Calais.

Meanwhile France was already experiencing the evils of war; the distress of the peasants was great; financial troubles set in, made worse by the tampering with the coin and the ever-increasing taxes. The second great defeat of the French took place at Poitiers (q.v.) in 1356, where the famous Black Prince led the English, and where King John, the successor of Philip VI., was taken prisoner. The States-General now for a time had control of the Administration. Their leaders were Etienne Marcel, provost of the Merchants, Robert le Coq, Bishop of Laon, and Charles the Bad of Navarre; but the revolt of the peasants (see JACQUERIE) in 1358 caused the more conservative classes to rally to the aid of the Dauphin Charles, who had been appointed regent by the States-General during King John's captivity. A brief breathing-spell was brought about in 1360 by the Peace of Bretigny (q.v.). John died in 1364, and his son Charles V. (q.v.), who was to be known as the 'Wise,' succeeded him. Himself an unwarlike man, he had the help of a great soldier in Du Guesclin (q.v.). His object was to regain the lands his father had lost, and by interfering with the possessions of the English in France, and attacking them in Spain, he forced a new war in 1369. Du Guesclin did not attempt to meet the English in the open, but harassed them, and cut off their supplies, and the English experienced a succession of misfortunes. Moreover, in 1376 the Black Prince died, and there was no one capable of taking his place; a year later Edward III. also died, and was succeeded by Richard II., a minor. When, in 1380, Charles VI. (q.v.) succeeded his father, few possessions remained to the English in France. In 1396 a truce for twenty-eight years was signed, which ended the first period of the war.

In France meanwhile Charles VI. had become insane, civil war broke out between the factions of the Armagnacs (q.v.) and the Burgundians, and Paris itself was distressed by the rising of the Cabochiens (q.v.) in 1413. In England Richard II. was overthrown by Henry IV. in 1399, and the latter was succeeded in 1413 by his son Henry V. But the House of Lancaster did not feel secure on the throne, and nothing would turn the attention of the people away from internal affairs as completely as a foreign war. So, in 1415 the war began again with the invasion of France by Henry V. France disunited offered an easy prey to the English, and soon the country was almost entirely in their possession, especially as they were aided by Philip, Duke of Burgundy (q.v.), who was eager to revenge the murder of his father, John the Fearless (q.v.). To the first year of this period belongs the battle of Agincourt (q.v.), the last of the three great English victories. On May 20, 1420, the Treaty of Troyes was signed, by which Henry V. was recognized as Regent of France and the heir of Charles VI., while the Dauphin was disowned by his own mother. The English held practically the whole of France.

In 1422 both Henry V. and Charles VI. died, and the former was succeeded by his son, Henry VI., a child of ten months, who was crowned Henry of France at Paris, his uncle Bedford being Regent. Charles VII., the successor of Charles VI., gave no signs of ability, and it seemed as if Henry VI. would really hold France permanently. But when affairs looked darkest France was saved by Joan of Arc (q.v.), who came forward and raised the siege of Orléans in 1429, thus turning the tide of war. From that time on the English slowly but surely lost ground, and when, in 1453, their last great captain, Talbot, fell at Castillon, the war ceased. Of all the extensive English conquests in France, nothing remained except the city of Calais and a small adjoining district. This France did not regain until 1558. Consult: Lavisse and Rambaud, *Histoire générale*, vol. iii. (Paris, 1894); Kitchin, *History of France*, vol. i. (Oxford, 1873); Hardy, *La Guerre de cent ans* (Paris, 1877); Dognon, *Les Armagnacs et les Bourguignons* (Toulouse, 1890); Wallon, *Jeanne d'Arc* (Paris, 1875); Longman, *Edward III.* (London, 1869). See FRANCE; ENGLAND; and BURGUNDY.

HU′NEKER, JAMES GIBBONS (1860—). An American musical writer and critic, born in Philadelphia, Pa. He was a pupil of Alfredo Barili, and of Ritter and Doutreleau for theory, in Paris. On the completion of his studies in the latter city he returned to New York, where he took up his permanent residence (1885). He was musical editor, and in 1902 became dramatic editor, of the New York *Sun*. His numerous contributions to the leading magazines and reviews contain vigorous and consistent presentations of his musical ideals. His works include: *Mezzotints in Modern Music* (1899); *Chopin, as Man and Musician* (1900), probably the most sympathetic life of Chopin for either musician or layman; and *Melomaniacs* (1902), a volume of stories on musical subjects, characteristically clever and imaginative.

HUNFALVY, hụn′fŏl-vē, JÁNOS (1820-88). An Hungarian geographer. He was born in the County of Zips, Hungary; became professor of statistics in the Academy of Kesmark; took part in the political agitation preceding the revolution of 1848; and was professor of history in the polytechnic school at Buda (1866-70), and of geography in the University of Pest after 1870. He was elected a member of the Hungarian Academy in 1865, and died in Budapest. Hunfalvy wrote a *Universal History* (1850-51), and a *Universal Geography;* of the latter, only two volumes appeared during the author's lifetime; the third was published in Budapest in 1890. An excellent descriptive work on Hungary, entitled *A magyar birodalom természeti viszonyainak leirása*, appeared in 1863-66. He issued in German his *Ungarn und Siebenbürgen in Originalansichten* (1856), and in both German and Magyar his work on the *Travels of Ladislas Magyar* (1859).

HUNFALVY, PÁL (1810-91). An Hungarian philologist and ethnographer, brother of the preceding. He was born in the County of Zips, studied law at Pest, and from 1842 to 1848 was professor of law at Kesmark. Then he was elected to the Hungarian Diet, in which he sat until it was dissolved, when he went to Pest, and in 1856 founded the philological review *Magyar Nyelvéazet*. Having been elected to the Hungarian Academy in 1859, he was for many years its librarian. He wrote: *Chrestomathia Fennica* (1861); *Utazás a Balt-tenger vidékein*, travels in the Baltic country (1871); treatises on the dialects of the Voguls (1872) and the Ostiaks (1875); a Magyar ethnography (1876; German by Schwicker, 1877); in Prochaska's series on the peoples of Austria-Hungary, a volume entitled *Die Ungarn oder Magyaren* (1881); and *Die Rumänen und ihre Ansprüche* (1883).

HUNGARIAN CONFESSION, THE. A confession of faith prepared by the Synod of Czenger, and adopted by the Reformed Church of Hungary, 1558. Its chief points were its emphatic rejection of the anti-Trinitarian views which had spread widely through Hungary of the Roman Catholic and Lutheran doctrines of the Eucharist, and of Anabaptism. Upon the point of reprobation it is silent. The Confession was superseded in 1567 by the Hungarian Synod's acceptance of the Second Helvetian Confession (1566). Consult Schaff, *Creeds of Christendom* (London, 1884).

HUNGARIAN GRASS. See FOXTAIL GRASS.

HUNGARIAN LANGUAGE. Called by those who speak it, Magyar; one of the Ural-Altaic group of languages, and both politically and literarily the most important representative of the group. With the exception of the closely allied Finnish (including the various Finnic dialects spoken in Russia, as well as the Lapp) and

Turkish, and the problematic Basque in the Pyrenees, it is to-day the only European language that does not belong to the Indo-Germanic group. The Ural-Altaic languages are divided into: (1) The Finno-Ugric and (2) Samoyedic, forming the Ural branch; and (3) Turkic, (4) Mongolic, and (5) Tungusic, forming the Altaic branch. The linguistic position of Hungarian was for many years the subject of a heated controversy, one school led by Vámbéry claiming its close affiliation with Turkish, while the other, under Hunfalvy, placed it where it is now recognized to belong, in the Finno-Ugric division.

Hungarian, like other Ural-Altaic tongues, is agglutinative in structure. It is built upon a basis of monosyllabic roots, through the addition of successive suffixes, which entail no inner change or structural modification in the original stem, but are merely set up in a row, one after another, like a row of bricks. The suffixes themselves, however, are modified in obedience to a law of so-called vowel harmony, which forms the most distinctive feature of this group of languages. The vowel sounds in Hungarian are divided into three classes: Open vowels, a, á, o, ó, u, ú; close vowels, e, ö, ő, ü, u; middle or neutral vowels, é, í, i. These neutrals may be used indifferently in words containing vowels of either of the other classes; but suffixes containing open or close vowels may stand only after a root containing a vowel of the same class; e.g. *házban*, 'in the house'; *kertben*, 'in the garden'; *váratandanak*, 'they will be expected'; *kéretendenek*, 'they will be entreated.' Hungarian has no inflectional endings, in the strictest sense of the term. It has no grammatical gender, or even suffixes indicative of sex; ő means 'he' or 'she,' *neki*, 'to him' or 'to her,' and so on. In expressing case relations, the bare stem is used regularly for the nominative, and to some extent for the possessive; the other cases are represented by means of the various postpositive particles which in Hungarian take the place of prepositions: e.g. *ház*, 'house'; *házban*, 'in the house'; *házbol*, 'out of the house'; *házelött*, 'in front of the house'; *házhoz*, 'toward the house'; *házal*, 'with the house'; *házat*, 'house' (accusative); *házalatt*, 'under the house'; *hazfelet*, 'above the house'; etc. A noteworthy peculiarity is the system of possessive suffixes employed with substantives, closely analogous to the personal endings of the verbs: e.g. *házam*, 'my house'; *házad*, 'thy house'; *háza*, 'his (her) house'; *házunk*, 'our house'; *házotok*, 'your house'; *házok*, 'their house.' In the absence of the auxiliary verb 'to have,' these possessive endings are used with the verb 'to be,' to denote ownership; *nekünk van házunk*, 'to us is house ours,' i.e. 'we have a house.' The verbal system in Hungarian is highly developed, giving the language a remarkable flexibility and a wide range of expression, though it offers to foreigners the chief difficulty in acquiring the language. There are two distinct forms of the verb, a definite and an indefinite form, differing throughout in their terminations. Their respective uses are exceedingly idiomatic, but in general the distinction between them depends upon whether or not the object of the verb is a definite person or thing: *látok*, 'I see'; *a kutyát látom*, 'I see the dog.' Hungarian is especially rich in derivative verbs. Not only are there suffixes which, added to the simple verbal stem, form causative, frequentative, inceptive, intensive, diminutive, reciprocate, potential, and desiderative stems, but with the characteristic facility of agglutinative languages, two or more of these suffixes may be used in combination, resulting in such linguistic anomalies as reflexive-frequentative-potential, intransitive-diminutive-potential, and transitive-frequentative-causative-potential verbs. The following examples will give some idea of the formation of derivative verbs: *látni*, 'to see'; *látogatni*, 'to visit'; *beszélnck*, 'they talk'; *beszélgetnek*, 'they chatter'; *beszélkednek*, 'they talk with each other'; *ver*, 'he beats'; *verinthet*, 'he can beat gently.' Among the peculiarities of the language are: the two-person suffix, *lak*, used in place of the regular ending of the first person, when the subject of the verb is 'I,' and the object 'thee' or 'you'; the use of the singular number with ordinal numerals, e.g. *tíz ház*, 'ten house' (not 'houses'); and the inverted order of name and surname, e.g. Arany János = John Arany; Petőfi Sándor = Alexander Petőfi. The requirements of emphasis often allow the words in a short Hungarian sentence to be put in an order the reverse of that in English: e.g. *Pénzemet elvett szolgálom*, 'money-my away-took servant-my' ('my servant took (away) my money'). The extent to which agglutination may be carried in the Hungarian language will be illustrated by the fact that it is possible to perform the following operation of word-building: *Magyar*, 'Hungarian'; *Magyarázni*, 'to render into Hungarian,' hence 'to make clear,' 'to translate'; *megmagyarázni*, 'to translate,' with the added notion of the accomplishment of the action, the syllable *meg* having the force of the German *be* and *er*; *megmagyarázhat*, 'he may translate'; *megmagyarázhatatlan*, 'that cannot be translated,' 'untranslatable'; *megmagyarázhatatlanabb*, 'more untranslatable'; *legmegmagyarázhatatlanabb*, 'most untranslatable'; plural subs. *legmegmagyarázhatatlanabbak*, 'the most untranslatable'; *a legmegmagyarázhatatlanabbakal*, 'with the most untranslatable.' A large number of names of common things in the Hungarian language are borrowed from the Slavic and German. Consult Hunfalvy, *Die Ungarn oder Magyaren* (Vienna, 1881); id., *Ethnographie von Ungarn* (German trans. with additions by Schwicker, Budapest, 1877); id., *Vámbérys Ursprung der Magyaren* (Vienna, 1883, refuting Vámbéry's theory of a Turkish relation); Riedl, *Magyarische Grammatik* (Vienna, 1858); Topler, *Grammar*, in German (Budapest, 1882); Singer, *Grammar*, in English (London, 1882); Ballagi, *German-Magyar and Magyar-German Dictionary* (3d ed., Budapest, 1874); Bizonfy, *English-Hungarian Dictionary* (ib., 1878); the *Dictionary of the Hungarian Academy of Sciences* (ib., 1862-74). See HUNGARY.

HUNGARIAN LITERATURE. Until modern times, literature in the vernacular did not flourish to any very great extent in Hungary. Latin was the general medium of cultured expression during the Middle Ages, and even recently it has sometimes sought to supplant the popular tongue in official and literary use. There are, however, documents in Hungarian or Magyar that belong to the mediæval period, most of them being translations of legends and of books of the Bible. The earliest continuous monument of Magyar is a funeral ceremonial dating from about the beginning of the thirteenth century. From the middle of the fifteenth century until the second half of the sixteenth century there was some activity in the way of translating into Hungarian the lives and legends of the saints and the individual books of the Bible.

With the religious revolution ordinarily termed the Reformation there was inaugurated a more important era of literary production. Poetry was cultivated by Valkai, Tinódi, Rimai, Balassa; but no very great degree of originality marked the ensuing period, for from then until the closing years of the eighteenth century Magyar literature was chiefly one of imitation. Considerable attention, however, was shown to some of the more striking forms of literary art. Thus, during the sixteenth and seventeenth centuries lyric verse was cultivated; the drama was started by Karádi (1569); and much prominence was given in the seventeenth century to epic verse, by the poems of Zrinyi, Gyöngyösi, Liszti, and others. Before the commencement of the eighteenth century there also appeared many works of a polemical, legal, and philological nature.

During the eighteenth century an endeavor was made by the central authorities to subordinate Hungarian life and patriotic feelings to Germanic ideals. The attempt failed, but it resulted temporarily in an undue production of books in Latin and German, to the detriment of composition in Magyar.

Near the close of the century, and with the advent of the French Revolution, there was a reaction, and societies for the cultivation of the Magyar tongue were formed, and various periodicals (the first newspaper in Hungarian was started by Ráth at Pressburg in the eighth decade of the eighteenth century) founded in the same interest. The new movement, which coincided with the great national awakening in Hungary, bore rich fruit; and within the first quarter of the nineteenth century all foreign elements gave way before it. The credit of this is largely due to Francis Kazinczy, the great linguistic reformer, and the poets Csokonai, Dayka, Verseghy, Alexander Kisfaludy, and Virág. The golden age of Hungarian literature was the thirty years preceding the revolution of 1848-49. Charles Kisfaludy, brother of Alexander, created the Hungarian drama by his tragedies and comedies, and his contemporary Katona won great fame as a writer of tragedy. Kölcsey, by his poems, ballads, prose writings, and orations, exerted a potent influence upon the patriotism of the nation. Fay's fables and Czuczor's and Vörösmarty's popular epics also did much to evoke and foster a true national feeling. In the lyrics of Alexander Petöfi, one of the greatest and most original of modern poets, whose "Up Magyars!" became the war-hymn of the Revolution, and in the epic verses and ballads of Arany, Hungarian literature reached its culmination in the middle of the nineteenth century. Their contemporary, Bajza, was not only an eminent lyrical poet, but an historical writer and æsthetical critic. Jósika (a disciple of Scott's) and Eötvös, eminent in the field of fiction, exercised a large influence. In the domain of political literature and journalism Széchenyi, Kossuth, Eötvös, and Csengeri hold high rank. In the field of history Horváth, Jászay, and Szalay deserve mention. In 1848 the powerful national awakening culminating in revolution supplied a new inspiration. National consciousness prompted Tompa's *Folk-tales* and *Folk-Sagas* (1846), and Erdélyi's *Hungarian Folk-Songs and Tales* (1846-48), with literary and æsthetic essays. Erdélyi's *Poems* (1844), lyric in the main, exercised a powerful influence over the famous trio, Petöfi, Arany, and Tompa. Arany (1817-82), the greatest ballad writer, surpassed him in formal perfection, and his greatest work also was a national epic, *Toldi*, in twelve cantos, celebrating the exploits of Toldi, the Hungarian Samson. Tompa (1819-68), unexcelled for sombre melancholy, struck the popular fancy with his *Poems* (1847). In drama, Szigligeti (1814-78), with a wonderful mastery of dramatic development and situation, mostly based on intrigue, created a new genre with *The Deserter* (1843), which still holds the boards. His masterpiece, *Mamma* (1857), and other successful plays called forth a host of successors, with the results that the Viennese farces and vaudevilles were banished from the Hungarian stage.

However, the Revolution of 1848-49 doomed many gifted writers to the dungeon, the scaffold, or exile. Lyric poety was under the ban; the activity aroused sought new channels. Arany translated Shakespeare, Tasso, Goethe; Szász followed suit with masterly versions of Molière, Hugo, Dante, Shakespeare, Tennyson, Goethe, Schiller, and Heine. At this time the novel, with its opportunities for covert allusions, and the drama gained ascendency. Jokai (1825—), novelist, poet, publicist, historian, and political champion, won his reputation, and Szász (1829—) proved his genius equally prominent in lyric poetry, fiction, and journalism. In 1860 the Austrian restraint was modified, and this gave a new impetus to literature. Tolnay's (1837—) *Ballads* (1861) were justly classed with Arany's; his *Lyric Poems* (1865) are strikingly original and tinged with melancholy, while the same brooding over life's problems characterizes his novels. Madach (1826-64) grappled with philosophical questions in *Man's Tragedy*, his best work. Rákosi (1842—) produced in *Esope* (1866) a comedy remarkable for poetic language and deft character-drawing, while his keen drama, *Magdalen*, and the æsthetic study of tragedy are among the best contributions to Hungarian drama.

The constitution of 1867 marked a new epoch: the fight for nationalism being over, the Hungarians could look more soberly upon themselves, the wider horizons of cosmopolitanism having opened new vistas. In short stories, novels, and especially in his comedies, *The Good Patriots* (1872) and *New Men* (1873), Toldy (1844-79) gave splendid satires of contemporary life. Csaky (1842—), the most fertile playwright, elicited applause with his *Proletarians*. Hungarian literature has its realistic writers, its psychological fiction, the short stories of Gyulai (1826—), who fosters the highest literary ideals in his *Poems* (1882), his critical studies and university lectures. Abrány (1849—), in the character-play, *The Infallible Man* and the novels, *Who Is Stronger?* and *The Philosophy of the Husband*, devoted himself to a study of the problems of marriage. Mikszáth (1849—), probably the most popular novelist of the day, champions the peasants in North Hungarian village stories, matchless in their style, language, and sympathetic tone. Finally Bródy, a wonderful complex of unusual powers and nonchalance in workmanship, represents symbolism hand in hand with the most uncompromising realism.

Consult: Toldy, *A magyar nemzeti irodalom története* (*A Description of the National Literature of Hungary*) (Budapest, 1851); the first volume, which deals with the mediæval period, was translated into German (ib., 1865); Dux, *Aus Ungarn* (Leipzig, 1880); Schwicker, *Geschichte der ungarischen Litteratür* (Leipzig, 1889); Neményi, *Das moderne Ungarn* (Berlin, 1883). Professor Beöthy, of the University of Budapest, is now preparing a history of Hungarian literature which is to be published in Gosse's English series of *Literatures of the World.*

HUNGARIAN MILLET. See Foxtail Grass.

HUNGARIAN MUSIC. See Magyar Music.

HUNGARIAN POLITICAL PARTIES. See Political Parties, paragraph on *Hungary.*

HUNGARIAN VERSION. See Bible.

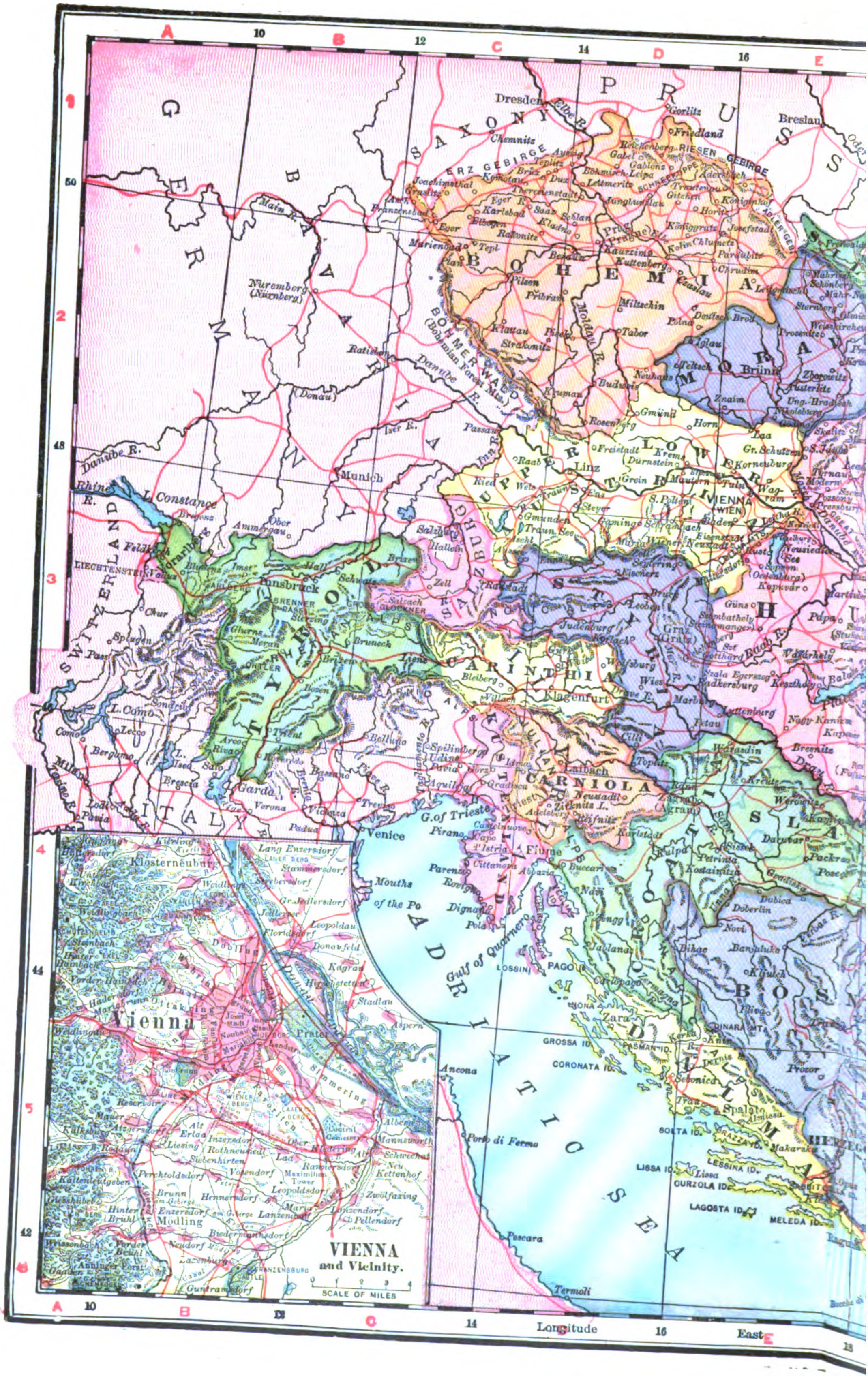
HUN'GARY, or, officially, The Lands of the Hungarian Crown. A kingdom of Central Europe, constituting one of the units in the dual monarchy of Austria-Hungary. It occupies a compact area of 125,039 square miles, comprising Hungary proper, with Transylvania and the crownlands of Croatia and Slavonia and Fiume, which are united to Hungary, but have more or less independent administrations. The Lands of the Hungarian Crown are often designated as Transleithania, or the country beyond the Leitha, the Austrian half of the monarchy being called Cisleithania, or the country on this side of the Leitha, the Leitha being a small river which forms a part of the boundary between the two divisions. The Hungarian name of the country is Magyarország (pronounced mŏd'yŏr-ŏr'säg), the 'land of the Magyars' (Hungarians); the German name is Ungarn. The Kingdom of Hungary, exclusive of Croatia and Slavonia, has the form of an oval with its longest axis lying east and west along the parallel of 46° N. It is encompassed for two-thirds of its perimeter by the broad curve of the Carpathian Mountains, which, beginning at the Danube a short distance below the Austro-Hungarian capital, Vienna, extend northeast, then east, then southeast and south, and finally west, forming a great wall on the side of Moravia, Galicia, Bukowina, and Rumania. On the west Hungary proper borders on Lower Austria and Styria, and on the south, for a distance of about 100 miles, on Servia, from which it is separated by the Danube. Southwest of Hungary proper, and separated from it by the Drave and the Danube, is the dependent Kingdom of Croatia and Slavonia, a great part of whose southern boundary is formed by the Save, separating it from Bosnia and Servia. Croatia has a coast-line on the Adriatic, and on an arm of this sea is Hungary's busy port of Fiume.

Topography. The two great orographic features of Hungary are the Carpathians and the vast plains which they inclose in their broad sweep of about 800 miles. Croatia and Slavonia are traversed by the eastern offshoots of the Alps. The Carpathians spread out laterally in minor ranges, and a large portion of Transylvania, in the extreme east of the Kingdom, is covered by them. The loftiest portions of the Carpathians are the High Tátra range in the north and the Transylvanian Alps in the southeast, which rise in peaks over 8000 feet above the sea. The culminating point of the High Tátra is the Gerlsdorferspitze, 8737 feet. The Carpathians, rising above their densely wooded lower slopes, present an imposing aspect, with their naked granite peaks, on whose summits but little snow rests through the winter. The great stretch of monotonously level land in the central and southern parts of Hungary proper is divided into the Little Hungarian and the Great Hungarian plains. The Little Hungarian Plain (Kis-Alföld) in the northwest comprises an area of about 5000 square miles, with a mean elevation of 450 feet. A portion of its surface is swampy, but for the most part it is exceedingly fertile. The Great Hungarian Plain (Alföld), which is the basis of Hungary's agricultural wealth, and the principal seat of the Magyar nationality, lies in the centre of the country between the Danube and the northeastern highlands. It covers an area of nearly 40,000 square miles, and lies at an average elevation of 325 feet above the sea. Its surface has a very gradual slope from north to south. Low hills of loess and sand, with deep, swampy hollows, lend the only appearance of relief. The surface is to a great extent treeless. The soil, especially in the broad alluvial lands, is exceedingly fertile. In spite of its monotony, the Alföld, with its interminable expanse, its boundless fields and wide-spreading villages, its great herds of cattle and droves of horses, and its picturesque types of peasants, herdsmen, and fishermen, is a region replete with interest for the traveler, and with poetical charm for its inhabitants.

Hydrography. The Danube receives the drainage of the entire country, except a small area in the north, which is drained into the Vistula. The course of the Danube from Pressburg to Orsova measures nearly 600 miles, and the river is navigable throughout. The principal tributary from the north is the Theiss (Tisza), which traverses the Great Hungarian Plain, and the principal affluent of which is the Maros; from the west and south the Danube receives the Drave and the Save. There are two large lakes in Hungary, the Balaton (Platten See), with an area of over 400 square miles (including submerged marshes), and the Neusiedler See or Fertö, 110 square miles, both lying in the western part, south of the Danube. In the Carpathians there are many beautiful little lakes of great depth, to which the Hungarians apply the name tengerszem, or 'eye of the sea.'

Climate. Hungary may be divided into two main climatic belts, the highland belt forming the northern, eastern, and southeastern portions, and the lowlands occupying the great central and southwestern parts. The winter, however, is severe throughout the country, and in the highland region the temperature sometimes falls as low as —18° F., while in the lowlands it seldom falls below 5°. The summers are oppressively hot in the central lowlands, the Alföld, where the mercury rises to 95° or even 105°. The rainfall differs considerably between the highlands and the lowlands, the annual precipitation in the former being 47 inches, and in the latter only half as much. The Alföld suffers frequently from prolonged droughts, but may at other times receive even excessive rains.

Geology and Mineral Resources. Hungary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CARINTHIA
CARNIOLA
CROATIA
SLAVONIA
DALMATIA
BOSNIA
HUNGARY
SWITZERLAND
LIECHTENSTEIN
ITALY
ADRIATIC SEA
Dresden
Chemnitz
Breslau
Görlitz
Friedland
RIESEN GEBIRGE
ERZ GEBIRGE
BÖHMER WALD (Bohemian Forest Mts.)
Prag (Prague)
Pilsen
Budweis
Brünn
Nuremberg (Nürnberg)
Ratisbon
Munich
Passau
Danube R.
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L. Constance
Linz
VIENNA (WIEN)
Salzburg
Innsbruck
Graz (Grätz)
Klagenfurt
Laibach
Trieste
G. of Trieste
Fiume
Agram (Zagreb)
Venice
Mouths of the Po
Gulf of Quarnero
Zara
Spalato
Ancona
Pescara
Termoli
Porto di Fermo
L. Como
L. Garda
Verona
Padua
Vicenza
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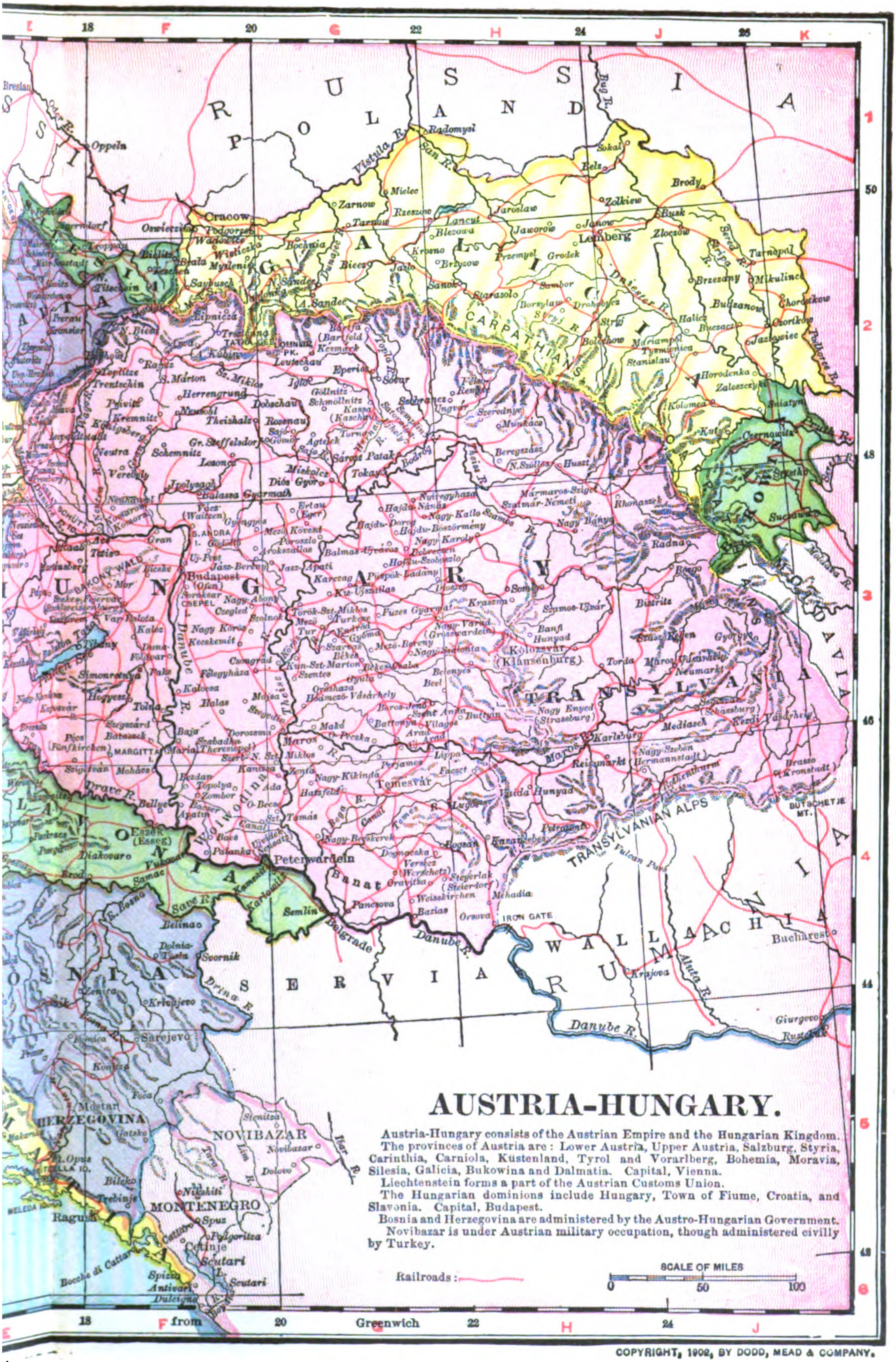

AUSTRIA-HUNGARY.

Austria-Hungary consists of the Austrian Empire and the Hungarian Kingdom.

The provinces of Austria are: Lower Austria, Upper Austria, Salzburg, Styria, Carinthia, Carniola, Küstenland, Tyrol and Vorarlberg, Bohemia, Moravia, Silesia, Galicia, Bukowina and Dalmatia. Capital, Vienna.

Liechtenstein forms a part of the Austrian Customs Union.

The Hungarian dominions include Hungary, Town of Fiume, Croatia, and Slavonia. Capital, Budapest.

Bosnia and Herzegovina are administered by the Austro-Hungarian Government.

Novibazar is under Austrian military occupation, though administered civilly by Turkey.

Railroads:

SCALE OF MILES
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stands in marked contrast to Austria, in that by far the greater part of its surface consists of geologically recent formations. The Great Plain, watered by the Danube and the Theiss, presents an almost unbroken surface of Quaternary and recent alluvial deposits, while the great northern and eastern mountain systems show a preponderance of Tertiary rocks on their surface. The Croatian and Slavonian highlands are of Jurassic and Triassic formation, and here also are the chief outcroppings of the coal-measures. Archæan diabases and granites occur in western Transylvania, and along the entire southern slope of the Carpathian Mountains runs an extensive belt of volcanic rocks. The nuclear mass of the Carpathians is largely constructed of granite. Hungary possesses a very considerable mineral wealth. There are great deposits of coal, iron, and salt; lead, copper, silver, and gold are found in various localities, the last mentioned chiefly along the rivers of Transylvania. Antimony, cobalt, nickel, mercury, and zinc also occur, and among the non-metallic minerals there are precious stones, kaolin, marble, and porphyry. The Hungarian opal is particularly worthy of mention. It is only within recent times that the wealth of coal and iron has begun to be exploited on a large scale. The deposits of salt in the county of Mármaros, in the Eastern Carpathians, which are worked by the State, are practically inexhaustible. (See table, under AUSTRIA-HUNGARY.) There are hundreds of mineral springs scattered throughout Hungary. Among the most celebrated are those at Tátra-Füred (Schmeks), in the Northern Carpathians, Mehádia (Baths of Hercules), near Orsova, and the Iron Gate of the Danube, and Füred, on Lake Balaton, and Harkány, near Fünfkirchen (Pécs).

AGRICULTURE, LIVE STOCK, FORESTS, ETC. Hungary is preëminently an agricultural country, about three-fourths of the total population being included in the agricultural class. The country made marked progress, both in the extent of the industry and in respect to agricultural methods, during the last two decades of the nineteenth century. Indeed, the development recently made in this and in other phases of its economic life has won for the country the appellation of the 'European Japan.' In respect, therefore, to its agricultural system, it belongs to Western Europe, and contrasts sharply with the adjoining regions to the east and south. A large majority of the cultivators of the soil are independent landowners. In 1895 48.5 per cent. of the total area (excluding properties consisting only of woods or pastures) was included in holdings which ranged in size from 5 to 100 acres. There are, however, a great many large estates belonging to the State and to members of the nobility, upon which the prevailing system of agriculture is very similar to that in vogue upon the large English estates. The improvement in agriculture is largely indebted to the activity of agricultural societies. The natural conditions are generally favorable to the industry, the great fertility of the soil being especially a marked feature of the Hungarian plain. In some respects this plain is comparable to the Western prairies of the United States, but, like that region, it is subject to an uncertain rainfall, and it contains considerable stretches of sandy, arid land as well as marshy tracts, which have never been brought under cultivation. While the products of the country are characterized by their great variety, Hungary is best known for its production of wheat, live stock (including horses), and wine, the first two entering the European markets in competition with American products. The area devoted to wheat increased from a little less than 6,500,000 acres (on an average) during the period 1881 to 1885 to 8,142,000 acres in 1900, and has become greater than the combined acreage of rye, barley, and oats, which are about on a level with each other in importance. The increase in the area devoted to wheat was principally in the sandy and previously uncultivated tracts of Central and Southern Hungary. Increased attention is also being given to corn, 5,469,000 acres having been devoted to its cultivation in 1900. A large variety of root crops are grown, of which the potato leads in importance, followed by beets, much less than half of the latter crop being sugar-beets. The yield of the principal agricultural staples will be found in the table under AUSTRIA-HUNGARY. Vine culture is extensively carried on in the hilly districts, the Hungarian wines being the most superior known to the market. The most famous Hungarian wines are those that bear the name of Tokay. During the latter part of the nineteenth century the phylloxera devastated the Hungarian vineyards, and their area greatly decreased. From an average of 367,360 hectares (907,747 acres) in the period 1881 to 1885 it decreased to 202,865 hectares (501,279 acres) in 1895, but had increased again in 1900 to 221,838 hectares (548,162 acres). Hungary has an extraordinary wealth of temperate-zone fruits. The grapes are unsurpassed in flavor, and the plums and watermelons are of an excellent quality. Apples, pears, cherries, etc., are very extensively raised, and some semi-tropical fruits are cultivated in the south. Nuts are found in great variety. There is a considerable production of tobacco, but this is under the monopoly of the Crown.

The Hungarian horse, though not large, is in great demand in the European market, because of its endurance and swiftness. The superiority of the breed is due to the care of the Government, which selects and owns most of the stallions kept in the country. The fondness of the Hungarian for horses is well expressed in the saying, "The Magyar was created on a horse." The number of horses in 1895 was 1,972,930. In the same year there were 5,829,483 head of cattle, 7,526,783 sheep, 6,446,134 hogs, and 286,392 goats. As compared with the figures of the 1884 census, there was a decided increase in all varieties of live stock, excepting sheep, the latter having suffered a large decrease. In some sections buffaloes are used in considerable numbers in tillage. The Hungarian oxen are characterized by the extraordinary spread of their horns. The principal forest area is in the Carpathian Mountains, and consists of forests of beech, oak, and pine. The numerous rivers of the country are rich in fish, and thus contribute an important item to the food-supply of the people.

MANUFACTURES. Since no duties can be collected upon the imports from Austria, the Hungarian manufacturing industries must compete with the long-established and highly developed Austrian industries; but in spite of this, much progress has been recently made. The Government has sought to encourage industries by favorable legislation, such as exemption from taxation. Most of the industries are being thoroughly modernized—concentrated under large plants, with highly improved machinery. The leading industries are those which draw their supplies from the abundant agricultural products of the country—flour-milling, brewing and distilling, sugar and tobacco manufactures, etc. Iron products, clothing, and many less important items are also included among the manufactures. Many of the large establishments are centred in Budapest.

Transportation and Commerce. In respect to railway mileage, Hungary will compare favorably with other European countries. Including Croatia and Slavonia, there were in 1899 10,500 miles of railway lines, about four-fifths of which were owned by the State, while the greater part of the remainder was operated by the State. Hungary has the distinction of having first applied the 'zone-tariff' system to its railroads. The Danube and its tributaries afford extensive facilities for water transportation. The navigation of some of the rivers, notably the Theiss, has been greatly improved through the shortening of the course by means of numerous cuts. The limited coast-line tends to restrict the country's participation in the sea-going trade. The principal port, however, Fiume, is rapidly growing in importance, and a subvention is granted to Hungarian vessels registering in this port, the number of which is rapidly increasing. Over three-fourths of the imports are from Austria, which takes a not much smaller proportion of the exports. This arises from the fact that the two countries are mutually complementary in respect to their products, and that trade between them is free, whereas there is a tariff barrier to the trade with other countries. Grain, cattle, and other farm products pass from Hungary to Austria in return for manufactured products, principally textiles. Germany occupies a second place in the trade with Hungary.

Government. The Emperor of Austria is King of Hungary. The foreign and military and naval affairs of the Austro-Hungarian Monarchy are conducted jointly by Austria (Cisleithania) and Hungary (Transleithania) through the medium of common ministries (including a ministry for the common finances) and the so-called Delegations representing the separate halves of the Monarchy. The crownland of Croatia-Slavonia enjoys autonomy in local affairs, having its own Diet and its own Ban or Governor. It is, however, also represented in the Hungarian Diet. Since 1867 Transylvania has been an integral part of Hungary. In the national Hungarian Parliament the Magyar interests are predominant, and the Magyar language is official throughout Hungary proper, being obligatory in schools, etc. Croatia and Slavonia are allowed the official use of their native language. A full exposition of the government and the educational system, and a statement of finances, will be found in the article Austria-Hungary.

Population. The population of the Lands of the Hungarian Crown in 1900 was 19,254,559, or 153 per square mile. This was somewhat more than two-fifths of the population of the Austro-Hungarian Monarchy, exclusive of Bosnia and Herzegovina. There are a large number of racial elements represented in Hungary, and the bitterness of racial feeling is the occasion of much political and social friction. The Magyar-speaking population numbers about 9,000,000, but this figure includes a large number of persons not of Magyar blood. The Rumans (Wallachs), mostly in Transylvania, number about 3,000,000, and the Southern Slavs (Croats and Serbs) are nearly as numerous. The Northern Slavs number about 2,500,000, about four-fifths of them being Slovaks, and the remainder mainly Ruthenians. Hungary has a German-speaking population of over 2,000,000. The Germans constitute an important element in many of the cities, and in Transylvania there is a German-speaking district known as the 'Saxon Land.' There are over 850,000 inhabitants of Jewish blood, most of whom are included in the Magyar-speaking population. Next to Rumania, Hungary contains a larger number of gypsies than any European country. They form a picturesque element in the population, and their music is quite a feature in the charms of rural life in Hungary. There are a number of Armenians and Bulgarians in the Kingdom. The population of Transylvania consists mostly of Rumans, and the Magyar element is but feebly represented in Croatia and Slavonia. The Magyars are, as a rule, the land-owners of the country. Hungary is unique among progressive European countries in the extent to which the different races still retain their own peculiar and long-established costumes. The costume of an Hungarian peasant is made of a linen shirt with long sleeves, reaching to the knee; a bodice ornamented with metal buttons or cords; wide linen trousers or tight-fitting ones, made of black or blue cloth, and stuck into leather boots ornamented with cords; a black round hat with feathers, or a black fur cap for head-dress, and a cloak made of close, coarse cloth and trimmed with fur, cords, etc., or a wide sleeveless sheepskin coat, worn also to some extent in summer. The costume of the Hungarian peasant woman is also very picturesque, and is made usually of lighter materials. The population is very largely centred in villages, some of which contain several thousand inhabitants, but there are a few large towns. Budapest in 1901 had a population of 732,322, or more than twice its population in 1881. Szegedin, with a population in 1901 of 102,991, is the only other town containing over 100,000 inhabitants. Cities having between this and 50,000 inhabitants in the order of size, are: Szabadka (Maria-Theresiopel), Debreczin, Pressburg (Pozsony), Hódmezö-Vásárhely, Agram (Zágráb), the capital of Croatia and Slavonia, Kecskemét, Arad, Temesvár, and Grosswardein (Nagy-Várad). Other well-known towns are: Klausenburg, Kronstadt, and Hermannstadt, the three principal places of Transylvania; Fiume, Kaschau, Oedenburg, Stuhlweissenburg, Raab, Eszék, and Gran (Esztergom), the seat of the Catholic Primate of Hungary. The population of the Kingdom of Hungary, in 1900, according to religions, was as follows: Roman Catholics, 9,920,000; Orthodox Greeks, 2,816,000; Calvinists, 2,441,000; Lutherans, 1,289,000; United Greeks and Catholic Armenians, 1,854,000; Israelites, 851,000; Unitarians, 68,500.

History. The Hungarians, or, as they call themselves, the Magyars, have been settled in their present abode just 1000 years. They constitute a branch of the Finno-Ugrian race (Uralo-

Altaic family), their nearest kin being the Finns. (See HUNGARIAN LANGUAGE.) They figure in the old writers as Ugri, Wengri, Ungri, Ungari, Hungari. Hungary, south and west of the Danube, was included in the Roman Province of Pannonia. The southeastern portion formed part of the Roman Province of Dacia. At the time of the great migration of nations which overwhelmed the Roman Empire of the West and in the succeeding period, the middle basin of the Danube was overrun by Germanic peoples (Ostrogoths, Gepidæ, and Longobards), by non-Aryan peoples (Huns and Avars), and by the Slavs. The Avars, who had established a realm in Pannonia, were conquered by Charles the Great, King of the Franks, at the close of the eighth century. A century later the Magyars (Hungarians) left their abodes on the plains to the east of the Carpathians (whither they are supposed to have come from the original home of the Finno-Ugrian race in Western Siberia), and moving westward under the lead of Arpád, who is sung as a great national leader by the Hungarians, they descended about 896 into the region which was to take its name from them. The invaders were a barbarous horde, who for more than half a century were the terror of the nations to the west and the south. They broke up the Moravian realm, made incursions into Germany and Italy, everywhere pillaging, burning, and slaughtering, and awakening superstitious terrors in the minds of the inhabitants, and carrying their devastations almost to the Straits of Dover. At last the German kings succeeded in putting an end to their onslaughts. They were defeated in 933 by Henry the Fowler on the Unstrut, and Otho the Great vanquished them on the Lech in 955. Forced to accommodate themselves to a settled existence, and in possession of a fruitful domain, the Hungarians showed themselves amenable to the civilizing influences emanating from without, and among other things they developed a capacity for the adoption of political institutions based upon Western models. Shortly before the close of the tenth century their ruler, Gejza, embraced Christianity, which began to take root in the nation. His son Stephen, the first King of Hungary, known as the Saint, was crowned in the year 1000 (some years after he began his rule), with a crown sent him by Pope Sylvester III., who at the same time bestowed on him the title of 'Apostolic Majesty.' With Saint Stephen, whose reign of over forty years terminated in 1038, a new era began for Hungary; Christianity took the place of heathen superstitions; the royal authority was firmly established; new laws were made, and the people advanced rapidly in civilization. After Stephen's death there was a reaction, and his immediate successors had to contend against a pagan revival and a general tendency to disintegration. Ladislas I., the Saint (1077-95), renowned for his wise legislation and for great personal valor, proved a worthy successor of Stephen; and under his rule Hungary again became a strong kingdom, with its boundaries increased by the acquisition of part of Croatia. Coloman (Kálmán) (1095-1114), known as the 'Learned,' was far in advance of his age, as many of his laws show. He gained possession of Dalmatia. Under King Gejza (1141-61), German colonists settled in Northern Hungary and in Transylvania, in consequence of which mining and several branches of industry made rapid progress. Andrew II. (1205-35) is known in connection with the Crusades. The Golden Bull, the Hungarian Magna Charta, was extorted from him by his nobles in 1222. Béla I. (1235-70) showed great qualities in subduing the pride of the nobles and in healing the wounds of his people after the terrible invasion of the Mongols in 1241. Andrew III. was the last male scion in the Arpád line—dying without issue in 1301. The crown of Hungary now became elective.

The succeeding period of Hungarian history, terminating with the battle of Mohács in 1526, witnessed the culmination and decline of the independent monarchy. Louis I., called the Great (1342-82), was the second King of the House of Anjou, which obtained the throne in 1307, being by his great-grandmother connected with the Arpád dynasty. Louis extended the power of the Hungarian kings over Moldavia and Wallachia, Bosnia, Servia, and parts of Bulgaria. In 1370 he was elected King of Poland. At home he reëstablished the authority of law, which under his predecessors had been openly violated by the powerful nobles. He promoted science, industry, and commerce. Sigismund (1386-1437), the son-in-law of Louis, succeeded him as King, but he is better known as Holy Roman Emperor. In the person of Sigismund's son-in-law, Albert V. of Austria (1438-39), the Hapsburgs first came into possession of the Hungarian throne. After his death the country was for a few years under the rule of King Ladislas of Poland, who was overwhelmed and slain by the Turks at Varna in 1444. He was succeeded by Ladislas the Posthumous, the son of Albert of Hapsburg, under whom the government was administered by John Hunyadi, an heroic figure in the wars between Christendom and the Turks. Hunyadi's son, Matthias I., ascended the throne in 1458. Matthias I.—better known as Matthias Corvinus—has been called not only the greatest King of Hungary, but also the greatest sovereign of his age. By his military successes, sagacity, and love of learning he raised his nation to a high pitch of splendor. From the death of Matthias (1490) to the fatal day of Mohács, Hungary exhibited the fiercest strife of factions —a protracted agony, preceding the loss of national independence. Among the many calamities during the reign of Ladislas of Bohemia (1490-1516), the peasant war occupies a prominent place. Dózsa (q.v.) and his insurgent bands, after having committed great havoc, were exterminated by the famous John Zápolya, Voivode of Transylvania. Louis II. (1516-26), who was also King of Bohemia, was but ten years old at the death of his father, Ladislas. The Turks, who had been making incursions into the Kingdom since the early part of the fifteenth century, took advantage of the anarchy under the young Louis to attempt the conquest of Hungary. In 1521 they captured Belgrade, and on August 29, 1526, an army of 100,000 men under Solyman the Magnificent crushed the forces of the Hungarians at Mohács, where the King and more than 20,000 of his men perished. The national party in Hungary chose John Zápolya, Voivode of Transylvania, to be Louis's successor, while a part of the nobles offered the royal crown to Ferdinand of Austria (brother of the Emperor Charles V).), between whom and Louis a double marriage connection had existed. After a struggle between the rivals and fresh invasions by Solyman the Magnificent (who had given his support to John Zápolya), Hungary, after 1541, remained rent into three parts. The central part of the Kingdom, with the capital, Buda, came into the immediate possession of the Turks.

The Austrian power for a long time was confined to the western part of the country. The religious policy of the Hapsburg Emperors and the activity of the Jesuits excited the fierce opposition of the Protestants, which culminated in 1604 in a great rising, headed by Stephen Bocskay (q.v.), who in the Peace of Vienna, in 1606, forced the Emperor Rudolph II. to grant religious freedom to his Protestant subjects in Hungary. At the beginning of the Thirty Years' War (1618-48), and toward its close, the princes of Transylvania were in arms for the Protestant cause against the Hapsburgs. Ferdinand III. (1637-57) was compelled to concede a large measure of self-government and religious freedom to the Hungarians; but his successor, Leopold I., initiated a policy of repression which led to a formidable uprising under Tökölyi (1678), who summoned the Turks to his aid. In 1683 Vienna, the capital of the Hapsburgs, after a heroic defense, was on the point of falling into the hands of the Moslems, when the victory achieved before the city by John Sobieski and the German princes turned the tide of war, and the power of Turkey collapsed. Buda was recovered by the Christians in 1686. After sanguinary vengeance had been wreaked on the leaders of the rebellion, Leopold I. forced the Hungarians in 1687 to declare the crown of Hungary forever hereditary in the House of Hapsburg. The dominion of the Turks rapidly disappeared from Hungary; the Treaty of Karlowitz (1699) left only the Banat in their hands; and that, too, was acquired by the Treaty of Passarowitz (1718) as a result of the victories of Prince Eugene. The Treaty of Karlowitz also secured Transylvania to the Hapsburgs. In 1703 Francis Rákóczy excited the Hungarians to rise in defense of their liberties against the Austrian House, and a struggle ensued which was not terminated until 1711, when Charles VI., immediately after his accession, found it necessary to come to terms with his Hungarian subjects. Charles VI. succeeded in gaining the approval of the Hungarians for his Pragmatic Sanction by the grant of extensive privileges; and after the Emperor's death, when the onslaught of Frederick the Great, the Saxons, the Bavarians, and the French threatened the dismemberment of the Austrian realm (1741), the nation rallied to the support of the young Queen, Maria Theresa, who had appealed to the National Diet, assembled at Pressburg. During her reign Hungary enjoyed an era of progress and prosperity. The reforms of Joseph II., her son and successor (1780-90), were received with violent opposition, because of their attack on the local liberties of the people through the institution of a strongly centralized administration. Bitter dissatisfaction was also aroused by the Emperor's attempts to make German the official language of the country. In 1790 Joseph II. saw himself driven to repeal his measures of reform, except those dealing with the abolition of serfdom and the establishment of freedom of worship. Under Leopold II. (1790-92) the old Constitution was restored; but his successor, Francis I. (1792-1835), ruled in an arbitrary fashion, and seldom troubled himself to assemble the Diet. In his reign a great political upheaval began to manifest itself in Hungary. The period after 1815 witnessed the rapid development of an intense national (Magyar) consciousness, which evinced itself in the demand for a strictly constitutional government and the enactment of widespread reforms. The strife of parties was carried from the legislative hall to the press, and the Liberals grew in strength as their support among the mass of the people increased. This great national and reform movement, which was headed by such men as Széchenyi, Batthyányi, Eötvös, Deák, and Kossuth, and which was accompanied by remarkable activity in the field of literature, constitutes a brilliant and stirring episode in the annals of Europe in the second quarter of the nineteenth century. Notable gains were the law of 1843, which made men not of noble blood eligible for office, and the enactment of measures for making the Magyar tongue the official language of Hungary. The revolutionary movement of 1848, which, emanating from France, convulsed a great part of Europe, brought upon Hungary a sudden and terrible catastrophe. In March of that year, immediately after the downfall of Metternich, who had so long guided the reactionary policy of Austria, the Hungarians were accorded an independent Ministry. Under its guidance the progress of liberal reform continued. But the hostile attitude of the Austrian Court toward the new order, and the encouragement which it gave to the Croats and Wallachs, who rose in revolt against the Magyar rule, resulted in an open war between the House of Hapsburg and Hungary, which, under the lead of Kossuth, declared its independence in April, 1849. After an heroic struggle (the details of which will be found in the article Austria-Hungary), Hungary succumbed to the combined forces of Austria and Russia, and was deprived of its constitutional liberties and treated as a conquered country. Before many years, however, the Emperor Francis Joseph was forced to recognize the necessity of some kind of reconciliation with his Hungarian subjects, and the blow sustained by Austria at the hands of Prussia in 1866 brought about the reërection of Hungary as a constitutional kingdom. The demands of the Hungarian people, as set forth by their great spokesman, Francis Deák, were acceded to in the Ausgleich of 1867, by which the present dualistic frame of the Austro-Hungarian Monarchy was established. The settlement was sealed by the coronation of Francis Joseph as King of Hungary on June 8, 1867, the ceremony taking place at Buda with extraordinary pomp. The revivified Magyar people now set itself with ardor to the task of the strengthening of its nationality, the introduction of political and ecclesiastical reforms, the extension of public education, and the development of the economic resources of the country. The nation enthusiastically followed the lead of the great Francis Deák, who, at his death, in 1876, had an able successor in Tisza. The patriotic zeal of the Magyars has at times transgressed the bounds of moderation, and the measures taken to extend the use of the Magyar tongue have excited fierce opposition, especially in Croatia. The economic progress of Hungary in the last three decades has been almost unprecedented, and the energy and enterprise displayed in the building of railways, the construction of public buildings, and the commercial expansion of the country have elicited the wonderment of travelers. In 1896 the millennial anniversary of the coming of the Magyars was celebrated by a national exposition held at the capital.

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HUNGARY WATER. A celebrated perfume or toilet water, the original receipt of which was given to a queen of Hungary by a hermit, in consequence of which it was called the 'Queen of Hungary Water,' subsequently abbreviated to 'Hungary Water.'

HUNGER. See DIGESTION, ORGANS OF.

HUNGERFORD, Mrs. MARGARET WOLFE (c.1855-97). An Irish novelist, known by her pseudonym The Duchess, though the majority of her books were published anonymously. She was born at Ross, County Cork, where her father, Fitzjohn Stannus Hamilton, was rector and vicar-choral of the cathedral. She was twice married—to Edward Argles and to Thomas H. Hungerford. The Duchess began to write in 1877, *Phyllis* appearing in that year, and her most successful novel, *Molly Bawn*, in 1878, and from that time to her death she published nearly thirty volumes of short stories and novels, which attained a remarkable popularity. They are sentimental and melodramatic; the plot, conventional; but the reproduction of the general air and small chatter of society, very truly done.

HUNG-SIU-TS'EUEN, hụng'sē-o͞o'chwĕn, or **HUNG-HSIU-CHUAN** (1812-64). A Hakka schoolmaster who originated and was the leader of the Tai-ping Rebellion (1850-64). He was born in a small village, about 30 miles from the city of Canton, in 1812; attended school from 7 to 16; became village schoolmaster, continued his own studies and passed all the examinations preliminary to that for the first degree, but failed again and again in the competition for the degree. He was subject to frequent illnesses, and in one attack, in 1837, is said to have lain in a trance for nearly forty days, during which he had a religious vision which profoundly impressed him. A few years later a friend found in Hung's bookcase some Christian books and tracts which Hung had obtained in Canton in 1833. The two began to study them, and Hung found in them the key to his visions, and was thereby inspired to destroy idols. They became converted, baptized each other, and began to preach. Hung set out for Kwang-si to convert the aborigines there, but lack of acquaintance with their language made the work difficult. He met others, however, who gladly accepted his teaching and themselves became zealous propagandists. About this time he joined a society of 'God-worshipers,' which had been formed in 1836, and soon became supreme in it. In 1845 he returned to his own province, made many converts, and in 1846 visited a Protestant missionary in Canton, and studied the Scriptures with him for two months, but was refused baptism, because the request was accompanied with an application for a monthly stipend. He returned to Kwang-si, and his disciples, mostly persons disaffected to the reigning dynasty, began to destroy temples and to demolish idols. In July, 1850, Hung and his followers, who were now numerous, broke out into open rebellion. At first Hung had styled himself the 'Brother of Christ'; he now became the 'Heavenly King' (T'ien Wang), and adopted the style of 'Heavenly Kingdom of Great Peace' (*Tai-ping Kwoh*) as that of the empire he was about to establish. He made Nanking his headquarters until 1864, writing Christian books, issuing edicts to his followers, attending to the printing and circulation of the Bible and other works, and directing the movements of his numerous generals and their immense armies.

On June 30, 1864, seeing the Imperial armies closing in on him and realizing that he could not hold out much longer, he poisoned himself. His body was later found and burned. (See CHINESE EMPIRE.) Consult: Meadows, *The Chinese and Their Rebellions* (London, 1856); Williams, *The Middle Kingdom* (New York, 1883); and Mayer's *Chinese Reader's Manual*.

HUNG-WU, hụng'wo͞o'. The name given to the period of years (1368-98) during which Chu Yuan-Chang, the founder of the Chinese dynasty of Ming (1368-1644), reigned, and commonly transferred by Europeans to the Emperor himself. He was a native of the Province of Ngan-hwei, and was born in 1328, the second son of a poor laborer. At 17 Chu entered a monastery as a novice, but in the troubles of the times this was burned down by rebels under the command of a maternal uncle of his, whose forces he joined. He was given a small command, scored victory after victory; and in 1355, on the death of his uncle, he was offered the post of assistant generalissimo. Declining this offer, he recovered from the Mongols, then the ruling dynasty, the whole left bank of the Yang-tse, and proclaimed himself Prince of Wu. Within two years he had become master of Kiang-si and part of Che-kiang; sent his generals north in 1367, in 1368 mounted the throne as Hung-wu, called his dynasty the Ming, or 'Illustrious,' and made his capital at the city which has since been known as Nanking, 'the southern capital.' In the same year he recovered the provinces of Fuh-kien, the two Kwang, and Shan-si, and brought Shen-si under his sway in 1369. In the following year the last Mongol Emperor died, the dynasty founded by Kublai Khan came to an inglorious end, and China was once more free from the yoke of aliens. In 1371 Sze-chuen and Liao-tung fell before him, and Yun-nan in 1381.

Hung-wu proved an able administrator, and became a liberal patron of education and of literature. He organized the present system of literary examinations, established a new penal code, abolished mutilation as a punishment, regulated taxes and placed the coinage on a proper basis, made Buddhism and Taoism State religions, and prohibited eunuchs from holding office. He also reestablished the customs of the T'ang dynasty (618-907) and labored for the welfare of his people. He had 24 sons, all of whom became princes, and set nine of them as governors over as many provinces. He died in 1398, and is known in history as *Tai-tsu,* his Temple name. He is popularly known, however, as the 'Beggar King,' in allusion to his early poverty. See Rémusat, *Nouveaux mélanges asiatiques* (2 vols., Paris, 1829).

HUNKERS (perhaps from Dutch *honk,* station, home). In American political history, the name applied for some years after 1843 to that part of the Democratic Party in the State of New York which stood for conservatism, and was arrayed against the radical faction of the same party, known as the Barnburners (q.v.). Factional differences had arisen in the party prior to 1843, but open and avowed antagonism may be said to date from that year. The Hunkers adhered to the regular Democratic Party in the Presidential contest of 1848, while their opponents united with the Free Soilers, and with them nominated Van Buren. After 1852 the two factions acted more or less in harmony in both State and National politics. Among the leaders of the Hunkers were Horatio Seymour, William L. Marcy, Samuel Beardsley, Edwin Croswell, and Daniel S. Dickinson. The name 'Hunkers' was also applied at times to the Conservative element of the Democratic Party in other States.

HUN'NERIC, or **HUNERIC.** King of the Vandals in Africa (?-484). He was the son of Genseric, whom he succeeded in 477. In 435 he had been sent to Rome as a hostage for his father's fidelity. One of his wives was a daughter of Theodoric, King of the Visigoths. Suspecting her of a plot against him, Hunneric cut off her nose and ears and sent her home. Another and later wife was Eudocia, the daughter of the Roman Emperor Valentinian III.

HUNNÉUS, ụn-nā'ụs, GEORGE (1831—). A Chilean statesman, born in Santiago. He was educated there and became professor of jurisprudence and political economy in the university the year after his graduation (1858). A fine speaker and a leader of the Liberal opposition, he was sent into exile by President Montt, but improved his time by studying the government and people of the United States. Recalled to his native land in 1861, he was once more sent to the House of Representatives and became its Speaker, as well as the Secretary of Public Instruction and Justice. Besides lecturing in the Santiago University, where he was rector, he continued to occupy high positions in the Chilean Government, such as president of the Senate and Secretary of Foreign Affairs. He published *Historia política de Chile* (1862); *La administración Montt* (1863); *Historia de la guerra con España* (1866); and *Historia de la guerra del Pacífico* (1883).

HUNOLD, ho͞o'nôlt, CHRISTIAN FRIEDRICH (1680-1721). A German author, known by his pseudonym Menantes. He was born at Wandersleben, and was educated at Jena. But means to carry on his studies failed him, and in 1700 he went to Hamburg, then the literary centre of Germany. Here the success of his novel, *Die verliebte und galante Welt* (1700), put an end to his precarious teaching and writing. This was quickly followed by *Der europäischen Höfe Liebes- und Heldengeschichte* (1704) and by *Satirischer Roman* (1705), which told so plainly the scandal of Hamburg—which Hunold knew only too well—that he was forced to leave the city (1706). He went to Thuringia; published *Die allerneueste Art zur reinen und galanten Poesie zu gelangen* (1706), besides text-books in rhetoric and style; and after many wanderings settled in Halle, where he became an instructor in literature, poetry, and jurisprudence, and where his works lost the earlier freedom and obscenity. Consult: Wedel, *Geheime Nachrichten und Briefe von Herrn Menantes Leben und Schriften* (Cologne, 1731), and Vogel, *Christian Friedrich Hunold* (Leipzig, 1897).

HUNS (Lat. *Hunni, Chunni,* Gk. Οὖννοι, *Ounnoi,* Χοῦννοι, *Chounnoi,* probably from Chin. *Hiong-nu,* name of a powerful Tatar tribe). The name of a nation of antiquity, which made repeated incursions upon the Roman dominions, and under Attila (q.v.), the most renowned of its leaders, brought the empires of both the East and the West to the verge of destruction.

The Huns are generally considered to be a people (or rather a collection of tribes) of Turko-Tatar affinities, the descendants perhaps of the Hiong-Nu, who figure in Chinese annals as making incursions and founding States in Central Asia as early as the second century B.C. Some authorities think that the bulk of Attila's hordes were of Turkic stock, and Theophanes in the eighth century writes of 'the Huns whom we commonly call Turks.' The distinction between 'white' and 'black' Huns, made by the mediæval writers, has led Bloch (1901) to put forward the view that we have here a dark race in process of transformation into a white one, but the uncertainty of the connotation of these epithets makes such a startling view even less probable. Like the modern Magyars, Osmanli Turks, etc., the ancient Huns no doubt assimilated themselves to the populations of their environment, and in Europe lost more and more of the distinctly Asiatic character. The 'white' Huns were probably not a little mixed with Asiatic Aryan blood (Iranian, etc.), before they entered upon their career in Europe. About B.C. 200 the Huns overran the Chinese Empire, defeated the Chinese armies in numerous engagements, and drove the Emperor Kao-ti himself to a capitulation and treaty. During the reign of Wu-ti (B.C. 141-87), the power of the Huns was much broken. Eventually they separated into two distinct camps, one of which, amounting to about 50,000 families, went southward, while the other endeavored to maintain itself in its original seat, but finally the most warlike went west and northwest in search of new homes. Of those that went northwest a large number established themselves for a while on the banks of the Volga. They then advanced into the territories of the Alani, a people dwelling between the Volga and the Don. At what period this took place is uncertain, but probably it was early in the fourth century. The Alani resisted the incursions of the Huns until at length a battle was fought on the banks of the Don, in which the Alani King was slain, and his army utterly routed; the vast majority of the survivors joined the invaders.

The Huns now invaded the country of the Goths, whose aged King, Hermannrich, roused himself to meet the invaders, but in vain. His successor, Withimir, encountered the Huns in a pitched battle, in which he was himself slain, and his countrymen utterly routed. The Goths now threw themselves upon the protection of the Emperor Valens, who in A.D. 376 gave permission to a great number of them to cross the Danube and settle in the countries on the south side as auxiliaries to the Roman arms against further invasion. The Huns now occupied all the territories that had been abandoned by the Goths; and when the latter not long afterwards revolted against Valens, the Huns also crossed the Danube and joined their arms to those of the Goths in hostilities against the Empire of the East. In the wars that followed the Huns were not so conspicuous as the Goths, their former enemies, and but little is known of them during the remainder of the fourth century. It is supposed, however, that early in the following century they were joined by fresh hordes. In the reign of Theodosius the Younger they had increased so considerably in power that their sovereign Rugilas, or Roas, was paid an annual tribute to secure the Empire of the East from further injury.

Rugilas, dying in the year 434, was succeeded in the sovereignty of the Huns by his nephews Attila and Bleda. The latter was put to death by his brother about 444. Attila carried his arms as far west as Gaul, where the Romans and Visigoths successfully encountered him on the Catalaunian Plain. In the following year he ravaged Italy, and Rome itself was saved, it is said, only through the awe which its Bishop, Leo I., inspired in the barbarian conqueror. With Attila's death, about 454, the power of the Huns was broken. A few feeble sovereigns succeeded him, but there was strife now everywhere among the nations that had submitted to Attila, and the Huns especially never regained their power. Many of them took service in the armies of the Romans, and others joined fresh hordes of invaders from the north and east, aiding them in their repeated attacks upon the Empire.

HUNT, HELEN. See JACKSON, HELEN (FISKE HUNT).

HUNT, HENRY (1773-1835). An English politician, born at Widdington Farm, Wiltshire, and educated by tutors and in private schools. Though destined for the ministry, he turned to farming, which he followed intermittently until within a few years of his death. He was imprisoned in 1800 for challenging to a duel the commanding officer of the Marlborough Troop, in 1810 for an assault upon a gamekeeper, and again in 1819 for two years for his part in the Peterloo massacre. In politics he was a Radical, and allied himself with Sir Francis Burdett, Horne Tooke, William Cobbett, and others of the same party, though he later published a pamphlet in which Burdett was charged with wavering loyalty to the reform, and was alienated from Cobbett through his own over-zealousness and political mistakes. He was often a candidate for Parliament and contested many elections. In 1831, through the retirement of the successful candidate, he obtained a seat from Preston, and advocated strenuously women's rights, universal suffrage, and the repeal of the corn laws. He managed to exercise considerable influence upon local politics, and his public speeches, though positive and demagogic, were always impressive; but his disagreeable personality found him few followers in Parliament, and in 1833 he retired to private life.

HUNT, HENRY JACKSON (1819-89). An American soldier, born in Detroit, Mich. His father, Samuel W. Hunt, was an army officer, and after his death the son was appointed to West Point, where he graduated in 1839. He was immediately assigned to the artillery arm of the service. His first active service was on the Canadian frontier in 1839, during the disturbances arising from the Canadian Rebellion, after which he continued in garrison duty until the Mexican War. He served with the Second Artillery in Scott's advance from Vera Cruz to the City of Mexico, distinguishing himself particularly at Contreras and Churubusco, and being twice wounded at the battle of Molino del Rey (September 8, 1847). He was brevetted captain and major for his services. He afterwards served on the frontier for some years, and in 1856 was appointed a member of the board to revise the system of light-artillery tactics. He was promoted captain in 1852, and at the outbreak of the Civil War was stationed at Fort Pickens, Fla., from April to June, 1861. Promoted major in May of that year, he commanded the artillery on the extreme left at the battle of Bull Run. He was in command of artillery in the defenses of Washington in the summer of 1861, and in the September following was promoted colonel, attached to General McClellan's staff, and assigned to organize and command the artillery reserve of the Army of the Potomac. He served throughout the Peninsular campaign, his disposition of the artillery at the battle of Malvern Hill (July 1, 1862) being especially praiseworthy, and in September became chief of artillery of the Army of the Potomac, a position which he held until the end of the war. He participated in the battle of South Mountain on September 14, 1862, and on the following day was appointed brigadier-general of United States volunteers. He served thereafter at Antietam, at Fredericksburg, where his artillery fire rendered possible the crossing of the Rappahannock, at Chancellorsville, and at Gettysburg, where the withering fire from his batteries rendered impossible the success of Pickett's brilliant charge and turned the tide of battle in favor of the Federal arms. After serving in the Wilderness campaign with distinction he continued on Grant's staff until the close of hostilities, receiving the brevet ranks of major-general of volunteers and brigadier-general in the United States Army. In the winter of 1865-66 he was in command of the military district of Arkansas. In 1866 he was made colonel in the reorganized army, placed in command of the Fifth Artillery, and appointed president of the permanent Artillery Board. He commanded the Department of the South from 1880 to 1883, when he retired and became governor of the National Soldiers' Home at Washington. He published *Instruction for Field Artillery* (1860), and three articles on the battle of Gettysburg in the *Century* (New York, 1886), later republished in *Battles and Leaders of the Civil War* (New York, 1887).

HUNT, ISAAC (1751-1809). An English lawyer and loyalist in the American Revolutionary era, father of Leigh Hunt, the poet. He was born in Barbados, West Indies, was sent to school in Philadelphia and studied law there, but the college declined to grant him an M.A. degree on account of his anonymous literary productions, which were highly displeasing to the popular sentiment of the time. When the Revolution was actually in progress he was mobbed and imprisoned for his activity in the royal cause, but fled to England, where he entered the Church. After preaching in London for a time he turned private tutor and wrote *The Political Family, or a Discourse Pointing out the Reciprocal Advantages which Flow from an Uninterrupted Union between Great Britain and her American Colonies* (1775), and *Right of Englishmen, an Antidote to the Poison of Thomas Paine* (1791).

HUNT, James Henry Leigh (1784-1859). An English poet and essayist, born at Southgate, Middlesex, October 19, 1784. He was a son of Isaac Hunt (q.v.). His mother was of Quaker descent. The boy was educated at Christ's Hospital, London. While at school he wrote verse in imitation of Collins, Gray, and others. A selection of these juvenile poems his father helped him to publish in 1801. In 1805 Leigh attracted some notice by his theatrical and literary criticism in the *News*, a short-lived paper started by his elder brother John. Two years later he made out of these contributions a book entitled *Critical Essays*. He also served as clerk in the office of his brother Stephen, who was an attorney, and for a short time he occupied a minor post in the War Office. In 1808 he joined with his brother John in founding a newspaper called the *Examiner*, of which he was editor for thirteen years. Hunt was a Liberal in politics before Liberalism had become fashionable; and for one of his articles, reflecting on the obesity of the Prince Regent—'a fat Adonis of fifty,' Hunt had called him—he was sentenced to pay a fine of £500, and to undergo two years' imprisonment. Hunt was happy enough in his confinement: he hid the prison bars with flowers, and received visits from Byron, Shelley, and Keats. Released in 1815, he published the next year *The Story of Rimini*, a verse narrative based on Dante's episode of Paolo and Francesca.

In 1818 appeared a volume of original poems and translations entitled *Foliage*. The next year he started another journal, the *Indicator* (continued for seventy-six weeks), in which first appeared some of his best essays. In 1821, having severed his London literary connections, he went to Italy to assume the editorship of a journal projected by Byron and Shelley. There were annoying delays; Shelley died; Byron and Hunt quarreled; and of this journal, called the *Liberal*, only four numbers appeared (1822-23). Returning to London, Hunt gave his version of the enterprise in *Lord Byron and Some of his Contemporaries* (1828). In the same year he began the *Companion* (28 nos.), a sequel to the *Indicator*. In 1834 he started the *London Journal*, which he edited for about two years. His principal works, besides those already mentioned, are: *Captain Sword and Captain Pen*, a poem (1835); *Legend of Florence*, a fine play (1840); *The Seer*, a selection from his essays in various magazines (1840); some remarkable prefaces to an edition of the Restoration dramatists (1840); *Palfrey, a Love Story of Old Times* (1842); *One Hundred Romances of Real Life* (1843), made up from contributions to the *London Journal* in 1834-35; *Imagination or Fancy*, containing the well-known essay on *What Is Poetry?* (1844); a volume of his collected poems (1844); *Wit and Humour*, selections from the English poets, with comments (1846); *Stories of the Italian Poets, with Lives* (1846); *Men, Women, and Books*, a delightful collection of miscellanies (1847); *A Jar of Honey from Mount Hybla* (1848), made up mostly of contributions to *Ainsworth's Magazine* in 1844; *The Autobiography* (1850); *Table Talk* (1851); and *The Old Court Suburb* (1855). In spite of his industry, Hunt was always poor. In 1844 Sir Percy Shelley settled upon him a pension of £120, which was augmented in 1847 by a Government pension of £200. He died at Putney, August 28, 1859.

Hunt undoubtedly wrote too much, but the best of his poems and essays render his reputation secure. *The Story of Rimini* is one of the finest narrative poems since Dryden; his *Palfrey* is delightful from its good spirits and bright, sunny glimpses of landscape and character; and *Abou-ben-Adhem* is a charming fable. As an essayist he is always cheerful and fanciful, and as a critic he is subtle and appreciative. His style is graceful. Consult: *Autobiography*, ed. by his son, T. Hunt (London, 1860); *Poetical Works* (ib., 1860), and *Correspondence* (ib., 1862); *Recollections of Charles and Mary Cowden Clarke* (London, 1878); Ireland, *List of Writings of Hazlitt and Hunt* (ib., 1868); Monkhouse, *Life of Hunt*, in "Great Writers Series" (ib., 1893); Johnson, *Leigh Hunt* (ib., 1896); selections from works by Ollier (ib., 1869, new ed. 1890), Symons (ib., 1887), Kent (ib., 1889), Johnson (ib., 1900-02), and *Classical Tales* (ib., 1894); *Dramatic Essays*, selected by Archer and Lowe (ib., 1894); *Tales*, with memoir, Knight (ib., 1890); reprint of *The Months*, edition of 1821, with introduction by Andrews (ib., 1897).

HUNT, Richard Morris (1828-95). An American architect, born at Brattleboro, Vt., the brother of William Morris Hunt. At fifteen he began the study of architecture in Geneva, Switzerland, and later studied at the Ecole des Beaux-Arts in Paris. After travel in Europe, Asia, and Egypt, he was employed as inspector of works on the buildings connecting the Tuileries with the Louvre, under his old master Lefuel, who had succeeded Visconti as architect in charge. In 1855 he returned to his own country, and was architect of the Capitol extension at Washington, the Lenox Library, the *Tribune* Building, New York, the United States Naval Observatory at Washington, the Divinity College Building at Yale, the Administration Building for the World's Fair, Chicago, and the Yorktown Monument. Among private houses by him are: W. K. Vanderbilt's, New York; the country house of George Vanderbilt, Biltmore, N. C.; and several beautiful summer houses at Newport, R. I., including the 'Marble House' and the 'Breakers.' Mr. Hunt exercised a powerful influence on the architecture of America, and many prominent architects were his pupils. He was one of the founders, and in 1888 became president of, the Institute of Architects. He was a knight of the Legion of Honor and a foreign associate of the Institute of France. In 1898 the associated architectural and art societies of New York City erected a beautiful memorial to him, including a bust of Mr. Hunt, in the wall of Central Park opposite the Lenox Library. It was designed by Daniel C. French and Bruce Price.

HUNT, Thomas Sterry (1826-92). An American scientist, born at Norwich, Conn. He studied chemistry and acted as laboratory assistant at Yale College. In 1847 he was made chemist and mineralogist to the Geological Survey of Canada, and, while holding this position, was also for several years professor of chemistry at Laval and McGill universities. In 1872 he resigned his position on the Geological Survey to become professor of geology at the Massachusetts Institute of Technology, and six years later he retired from official service. His extensive and fruitful researches in general and economic geology, in pure and applied chemistry, and in mineralogy, have won for him a place of eminence in the scientific world, and universities and learned societies the world over conferred upon him their honors. He was made a Fellow of the Royal Society of London, a Chevalier of the Legion of Honor in France, an honorary Doctor of Laws of the University of Cambridge, president of the American Chemical Society (1880), and president of the Royal Society of Canada (1884). Besides a very large number of papers on special scientific topics, his publications include the following works: *Chemical and Geological Essays* (1874); *Azoic Rocks* (1878); *The Domain of Physiology* (2d ed. 1882); *Mineral Physiology and Physiography* (1886); *A New Basis for Chemistry* (1887).

HUNT, WARD (1810-86). An American jurist, born in Utica, N. Y. He was educated at Union College, prepared himself for his legal career in Litchfield, Conn., and after following his profession for many years in his native town, of which he was Mayor in 1844, he was raised to the Court of Appeals in New York (1865), and seven years later to the bench of the United States Supreme Court. This position he occupied for ten years, and then retired with a pension.

HUNT, WILLIAM HENRY (1790-1864). An English painter in water-colors. He was born in London, March 28, 1790, the son of a tinplate worker. A cripple from childhood, he was apprenticed at an early age to John Varley (q.v.), and made such rapid progress in painting that he could exhibit at the Academy at the age of seventeen. He was much encouraged in his studies by the friendship and patronage of Dr. Thomas Munro, of Adelphi Terrace. He at first painted in oil, but later devoted himself exclusively to water-color. He became an important member of the Water Color Society in 1827, exhibiting a large number of drawings—usually twenty-five—each year. He began by painting landscapes and still life, but later did rustic scenes and sketches of the sea, visiting Hastings every year for thirty years. Toward the close of his career he made many drawings of flowers and fruits. He excelled in depicting common objects, seen in the sunlight, at a short distance, and he preferred pure to mixed colors. His genre subjects are nearly always rustic, and are distinguished by a delightful vein of humor. Among the best known are: "Too Hot," the "Cardplayers," the "Fly-fisher," the "Attack," and the "Defeat." The South Kensington Museum contains a large number of his aquarelles, but the best collections are those of James Orrock and Louis Huth. Hunt died in London, February 10, 1864. Consult: Redgrave, *A Century of British Painters* (London, 1890); Ruskin, *Notes on Samuel Prout and William Hunt* (London, 1879).

HUNT, WILLIAM HENRY (1824-84). An American lawyer and politician, born in Charleston, S. C. After studying for two years at Yale College in the class of 1843, he removed to Louisiana, studied law, and was admitted to the bar in 1844. For many years he was a professor in a law school in New Orleans. Throughout the Civil War he favored the Union cause, and ever afterwards remained a stanch Republican. In 1876 he was appointed Attorney-General of Louisiana to fill a vacancy, and was regularly nominated for that position in the same year; but the vote was contested, and largely through the agency of President Hayes the Democratic candidates were placed in office. Hunt was made a judge of the United States Court of Claims in 1878, was prominently mentioned two years later as a successor to Justice Strong on the Supreme Court bench, and in 1881 was appointed by Garfield Secretary of the Navy, after he had declined the judgeship of the United States Circuit Court of the Fifth District. He retired when Arthur reorganized Garfield's Cabinet, and in 1882 was made Minister to Russia.

HUNT, WILLIAM HOLMAN (1827—). An English historical painter. He was born in London in April, 1827. He was intended for commercial life, but his taste for painting prevailing, he studied for a short time under John Varley (q.v.), and in 1854 he entered the schools of the Royal Academy. At the age of nineteen he exhibited his first picture at the Academy exhibition. Together with Rossetti and Millais, Hunt founded the Pre-Raphaelite Brotherhood (q.v.). His first painting that was an exponent of its principles was "The Flight of Madeline and Porphyro," a subject taken from Keats's *Eve of Saint Agnes*. He has been the most consistent follower of the Pre-Raphaelite movement, and even in his later works has remained unaffected by a modern artistic development. He soon turned to religious subjects, to which he is peculiarly adapted, and became one of the greatest modern exponents of Christianity. His works are full of strong religious feeling, and are characterized by an absolute fidelity to nature, to the extent of a hard realism. Every detail, even the leaves and blades of grass, is painted with the utmost minuteness. His works are the triumph of industry. He went to Palestine to study the figures and landscapes of his religious subjects, spending four years there in preparation for his picture "Christ Discovered in the Temple." This industry has been richly rewarded by the public, which bought the latter picture for £5000, and "The Shadow of Death" for £10,000.

The best known of Hunt's works is his "Light of the World," now in Keble College, Oxford. It represents Christ wandering through the night, with a lantern in His hand, and an embroidered robe thrown over His shoulders; it is executed with great detail and realism. Among his earlier works are a "Converted Christian Family Sheltering Christian Missionaries from the Druids" (1849), in the Taylor Museum, Oxford; "Rienzi Vowing to Avenge His Brother's Death" (1841); the "Hireling Shepherd" (1852); and the "Awakened Conscience" (1854). The "Scapegoat" (1856) is a strange religious production, representing a goat perishing among the miasmas of the Dead Sea. In the Gallery of Birmingham is the "Christ Discovered in the Temple"

(1873); at Manchester, the "Shadow of Death" (1873), also called "Christ, the Carpenter," and "Valentine and Silvia;" at Liverpool, the "Triumph of the Innocents" (1885). Among his latest works are: "Isabella and the Pot of Basil;" "May Morning in Magdalen Tower;" "Holy Fire in the Church of the Sepulchre at Jerusalem."

HUNT, William Morris (1824-79). An American landscape, figure, and portrait painter. He was born at Brattleboro, Vt., March 31, 1824. He entered Harvard College in 1840, but, compelled to leave on account of his health, he traveled in Europe. He at first studied sculpture at the Academy of Düsseldorf in 1846, and afterwards took up painting with Couture in Paris. Attracted to Barbizon, he became a friend and follower of Millet, who exercised the strongest influence on his art. In 1855 Hunt returned to the United States, and soon afterwards established himself in Boston. There he became a very successful teacher of painting, and exercised a marked influence upon American art. He taught his pupils the new art methods of Paris, and influenced large classes, not only by the superiority of his aims, but by his own work. His criticisms and sayings in his studio were compiled and edited by his pupil, Helen M. Knowlton, and published under the title *Talks on Art* (3 vols., Boston, 1875-82). Under sudden derangement he committed suicide on the Isle of Shoals, September 8, 1879. His work is fine in color, and masterly in execution. At first he showed a preference for figure subjects—peasants, children, flower-girls, and Parisian types. In portrait painting his aim was to represent the character of the person, even at the expense of finish in the accessories. His later subjects were principally landscapes, in which he showed largeness of style and vigor of execution.

Among his most important figure subjects are: "Head of a Jewess;" "Sheep Shearing at Barbizon;" "The Farmers' Return;" "The Fortune-teller;" "The Prodigal Son." The Boston Museum contains a number of his works: "Girl with the Kitten," "Girl Reading," "Peasant Girl at Barbizon," "Marguerite," "Hurdy-Gurdy Boy," and a portrait of the artist. His portraits include those of Chief Justice Gray, Mrs. F. G. Ward, Mrs. Charles Francis Adams, Mrs. G. W. Long, William H. Gardiner, and William M. Evarts. Among his landscapes are: "Gloucester Harbor," "Newton Lower Falls," "Coast Scene at Magnolia, Mass.," and "Dead in the Snow." His most ambitious works, the "Flight of Night," and other decorations in the Capitol at Albany, were executed in 1878, not long before his death.

HÜNTEN, hụn′ten, Emil (1827-1902). A German battle painter, born in Paris. He was a pupil of Flandrin and Vernet; later studied in Antwerp under Wappers and Dyckmans, and after settling at Düsseldorf received further instruction from Camphausen. His first picture of importance was the "Charge of Cuirassiers of the Time of Frederick II." He was with the army in Schleswig (1864), accompanied the Army of the Main in 1866, and provided illustrations for a history of that campaign. Many of his other works illustrate episodes of the Franco-Prussian and the Seven Years' wars.

HUNT′ER, David (1802-86). An American soldier, born in Washington, D. C. He graduated at West Point in 1822, and from 1833 to 1836 served as captain of dragoons in the far West. He held the rank of major throughout the Mexican War, entered the Civil War as colonel of the Sixth Cavalry, and headed the Second Division of the Army of the Potomac at the first battle of Bull Run, where he was severely wounded. He was afterwards promoted to be a major-general of volunteers (1861); commanded the Western Department, and the Department of Kansas; was then appointed head of the Southern Department, and was the first to enlist colored troops. He gave a premature order in 1862 for the manumission of slaves in Georgia, Florida, and South Carolina, which President Lincoln countermanded, but the Confederate Congress outlawed the author. In 1864 Hunter was head of the Department of West Virginia, and led 18,000 men to an unsuccessful attack upon Lynchburg, leaving the valley of Virginia exposed by his retreat. General Grant defended his reputation when it was attacked. Hunter presided at the court which tried the conspirators in the assassination of Lincoln. At the close of the war he was brevetted Brigadier and Major-General in the Regular Army.

HUNTER, Edward (1839—). An American soldier, born at Gardiner, Me. He graduated at West Point in 1865, was commissioned in the Army as second lieutenant of the Twelfth Infantry, U. S. A. In 1867-69 he was aide-de-camp to General Getty at Santa Fé, N. M., and participated in the battle of December 25, 1868, against the Arapahoe and Cheyenne Indians. Transferred to the First Cavalry, U. S. A., in 1870, until 1886 he served in California, Nevada, Washington, and Montana, and in 1879 was promoted to be captain. In 1888 he became major and judge-advocate, and as such served in the Division of the Pacific and the Department of California from 1889 to 1895. He was made lieutenant-colonel in 1895, and served as deputy judge-advocate in the Department of Dakota until 1898, and in that year went with General Brooke to Porto Rico as judge-advocate and mustering officer. In 1899 he was appointed judge-advocate of the Department of the Pacific.

HUNTER, John (1728-93). A celebrated English physiologist and surgeon, born at Long Calderwood, Glasgow, Scotland, the youngest of ten children. After a deficient primary education he was apprenticed to a cabinet-maker; but in 1748 he began to make up deficiencies in his education, and applied himself to anatomy under his brother's tuition. He studied under Cheselden at Chelsea Hospital, and under Pott between 1749 and 1753, and at Oxford from 1753 to 1754; became a hospital pupil in surgery in 1754, and was made house surgeon at Saint George's Hospital in 1756. He joined the Army as staff surgeon, serving in France and Portugal from 1761 to 1763; practiced surgery in London from 1763; was made a Fellow of the Royal Society in 1767; became surgeon to Saint George's Hospital in 1768; surgeon extraordinary to the King in 1776; and deputy surgeon-general to the Army in 1786. He received the Copley medal from the Royal Society in 1787. He was a man of great industry, the boldest and best operative surgeon of his day, as well as the greatest anatomist known, and a marvelous zoölogist.

He invented the process of tying an artery on the cardiac side for cure of aneurism. His museum contained at the time of his death 10,563 specimens and preparations illustrative of human and comparative anatomy, physiology, pathology, and natural history. He died in comparative poverty, and his collection was purchased, two years after his death, by the Government for £15,000, and was presented to the Royal College of Surgeons. In addition to numerous papers contributed to the *Transactions* of the Royal and other learned societies, he published the following independent works: *A Treatise on the Natural History of the Human Teeth* (Part I. 1771; Part II. 1778); *A Treatise on the Venereal Disease* (1786); *Observations on Certain Parts of the Animal Economy* (1786); and *A Treatise on the Blood, Inflammation, and Gunshot Wounds* (1794). Consult Palmer, *The Works of John Hunter, F.R.S., with Notes* (4 vols., London, 1838). To this is prefixed *The Life of John Hunter, F.R.S.*, by Otley.

HUNTER, JOHN DUNN (c.1798-1827). An American adventurer from a Southern settlement who claimed that he had been captured and reared by Western Indians. His account of explorations with them, and of their manners and customs, was ultimately discredited, but it is certain that when he came to New Orleans in 1817 he knew no English, and that he studied it there and in Kentucky. He was lionized while visiting England, but on his return to America did nothing but make trouble among the Mexicans and Indians, and was finally killed by one of the latter. The work by which he is known was published in London and Philadelphia, and translated into German and Swedish. The English edition is called *Memoirs of a Captivity Among the Indians of North America from Childhood to the Age of Nineteen* (1823).

HUNTER, JOSEPH (1783-1861). An English literary antiquary, born at Sheffield. He studied for the Presbyterian ministry; in 1809 was appointed to a congregation in Bath, and in 1833 removed to London, where he became subcommissioner of the public records, and assistant keeper (1838). His researches began in early life and extended over his entire career. He edited various volumes of records, made discoveries in regard to the first settlements in America, and illustrated the text of Shakespeare's plays by investigations in many directions. His voluminous notes are now in the British Museum. Among his publications are: *Hallamshire* (1819); *Disquisitions on Shakespeare's Tempest* (1839); *New Illustrations of the Life, Studies, and Writings of Shakespeare* (1845); *Milton* (1850); *Robin Hood* (1852); *Early History of the Founders of New Plymouth* (1849); and the *Church and Congregation of Protestant Separatists at Scrooby* (1854).

HUNTER, MRS. LEO. A poet and lion-hunter, whose literary reception and recitation of her own "Ode to an Expiring Frog" form one of the amusing incidents in Dickens's *Pickwick Papers.*

HUNTER, PETER (1746-1805). A Canadian governor, born in Scotland. He chose the army as his profession, and in 1799 was made lieutenant-general. In the same year he was appointed Lieutenant-Governor of Upper Canada, and remained in office for six years. He was a fairly successful administrator, though he had little sympathy with the wishes of the Legislative Assembly, and his acts were mainly dictated by an irresponsible executive council.

HUNTER, ROBERT (?-1734). A British Colonial Governor of New York and Jamaica. He belonged to an Ayrshire family. He served on the Continent, fought at Blenheim, and rose to be a colonel of dragoons before he was made Lieutenant-Governor of Virginia in 1707. The vessel in which he had sailed to the Colony was taken by the French, and he was held a prisoner, but soon was exchanged for the Bishop of Quebec. In 1710 he came to America again, this time with a ship-load of persecuted German Protestants who had sought an asylum in England, and Colonel Hunter, being now Governor of New York, was able to establish them comfortably along the Hudson, though the settlement was an unending care to himself. Difficulties between royal governors and colonial assemblies were rife even in his day, and he doubtless rejoiced to return to England in 1719; but he was sent out again ten years afterwards to be Governor of Jamaica and major-general of the local troops, positions which he filled most creditably until his death.

HUNTER, ROBERT MERCER TALIAFERRO (1809-87). An American politician, born in Essex County, Virginia. He graduated at the University of Virginia in 1829, and after studying law at the Winchester (Va.) Law School began practicing in his native county. His political career began in 1833 with his election to the State Legislature, and in 1837 he took his seat in the National House of Representatives, to which he had been elected as a Democrat. From the beginning he attracted attention by his earnest opposition to Clay's protective policy and the United States bank scheme. Reëlected to the next Congress, the Twenty-sixth, he was, although only thirty years old, chosen Speaker of the House. He was reëlected to the Twenty-seventh Congress, and was defeated for the Twenty-eighth (1843-45); but was reëlected to the Twenty-ninth, and served until his elevation to the United States Senate in 1847. He served as Senator until the outbreak of the Civil War, withdrew after the secession of Virginia, and was expelled in July, 1861. He was a radical States-Rights Democrat, and a champion of Texas annexation, the Fugitive-Slave Law, and all other legislation favorable to the slave power. As chairman of the Senate Committee on Finance for many years, he was a prominent figure in financial legislation, was the author of the low tariff of 1857, and the originator of the bonded warehouse system. In 1860 he was a prominent candidate for the Democratic nomination for President before the Charleston Convention, receiving, next to Douglas, the highest number of votes. He was a member of the first Provisional Confederate Congress, was Secretary of State in the Confederate Cabinet for a few months in 1862, and was then chosen from Virginia a Senator in the Confederate Senate, where he served throughout the war, leading the opposition to the Davis Administration in that body. In 1865 he was one of the Confederate commissioners with Alexander Stephens and J. A. Campbell to confer with President Lincoln and Secretary Seward at Hampton Roads. (See HAMPTON ROADS CONFERENCE.) After the war he was Treasurer of the State of Virginia from

1874 to 1880, but took no part in national politics.

HUNTER, William (1718-83). A celebrated Scotch surgeon, the elder brother of John Hunter. He was born at Long Calderwood, Lanarkshire. He took up the study of theology at the University of Glasgow, but decided to devote himself to the study and practice of medicine. In 1746 he was invited by a society of naval surgeons to deliver a course of lectures on operative surgery. After 1748 he confined himself almost exclusively to obstetrics, and became connected with the Middlesex and the British lying-in-hospitals. In 1764 he became physician extraordinary to Queen Charlotte; and in 1768 was appointed professor of anatomy in the Royal Academy. His principal work is an *Anatomical Description of the Human Gravid Uterus and Its Contents* (1783).

HUNTER, Sir William Wilson (1840-1900). A British Indian administrator, scholar, and statistician, born in Glasgow. Educated at Glasgow, Paris, and Bonn, he entered the Indian civil service in 1862. Seven years after he was transferred from Orissa and put on special duty to plan an Imperial gazetteer of British India; in 1871 he was appointed director-general of statistics. Ten years later, after the appearance of the first edition of the *Imperial Gazetteer,* which was edited by Hunter, and is one of the greatest works of reference on India, he was made a member of the Governor-General's council, and in 1882 acted as president of the educational commission. He retired from the service in 1887, settled at Oxford, and became a regular correspondent of the London *Times* on affairs in India. He wrote in a vigorous and picturesque style, and for the most part with great scientific accuracy: *Annals of Rural Bengal* (5th ed. 1872); *Comparative Dictionary of the Non-Aryan Languages of India and High Asia* (1868), which has more valuable material than original induction, as Hunter himself saw afterwards; a *Statistical Account of Bengal* (1875-77); *Statistical Account of Assam* (1879); *A Brief History of the Indian Peoples* (1880; and, in more expanded form, 1895, under the title *The Indian Empire*): *Lord Mayo* and *Lord Dalhousie* (1890), in *Rulers of India*; *Bombay, 1885-1890* (1892); an idyll, *The Old Missionary* (1895); a biography of his friend Brian Houghton Hodgson (1896); *The Thackerays in India* (1897); and the incomplete but valuable *History of British India* (1899-1900). Consult Skrine, *Life of Sir William Wilson Hunter* (London, 1901).

HUNTING (AS. *huntung,* from *huntian,* to hunt; connected with Goth. *hinþan,* to seize, and probably with Eng. *hand*). The pursuit of game, especially as a recreation or sport. The true sportsman is a strong supporter of every law designed for the protection of game (see Game Laws), and rarely kills game for any other purpose than for eating, unless it is a dangerous creature or a nuisance. Thus an animal like the fox is hunted partly on account of its destructiveness and partly for the enjoyment to be obtained in its pursuit. *Drag-hunting,* in which the hounds follow the trail of an aniseed bag which has been previously dragged over a selected course, is a favorite substitute for fox-hunting. Hunting is a very ancient amusement, and the pursuit of game, either as a pastime or for the necessities of subsistence, has from the earliest times been one of the most prominent occupations of the human race. According to tradition, Alexander the Great paid a large sum for a treatise on this subject by Aristotle, while the chase has been described by Appianus, Nemesianus, and many other classic authors.

Firearms. The improvement in firearms has worked a great revolution in the hunting and shooting of such animals and birds as come under the game laws, or are regarded as permissible quarry by the huntsman. Nevertheless, it has made more necessary than ever the study of natural history and woodcraft by the would-be hunter. In order to be a first-class shot, or to attain dexterity in the use of the sporting gun, it is necessary that the weapon should 'fit' the shooter. Proper regard must be paid to the weight of the weapon, and the ease with which it can be manipulated; it must be adapted to his chest, length of arm, etc., so that it may be readily brought into service without any straining of the body, arms, or muscles of the neck. An experienced gunsmith should be consulted, who will easily decide the weapon best suited for his customer. The weight of the weapon depends largely on the size of the bore and the length of the barrels. For a more detailed description of the various types of shotgun for every variety of game, the reader is referred to Shotgun.

Dogs. A description of the various varieties of dogs used in the hunting or pursuit of game will be found under Field Dogs. Other closely related articles are Game-Preserve; Horse; and Horsemanship.

There are many methods of hunting, and some animals necessitate a pursuit in special ways, but the killing of game by shooting is by far the most common method, and the one to which this article is largely devoted. In Europe, and in Great Britain particularly, the various forms of shooting may be grouped as follows: *Open Shooting.*—Partridge, grouse, plover, quail, landrail, snipe, etc.; hares and rabbits. *Covert Shooting.*—Pheasants, woodcocks, hares, and rabbits. *River and Pond Shooting.*—Wild duck, widgeon, teal, etc. *Salt-Water Wild-fowl Shooting.*—Such marine wild-fowl as the wild swan, wild goose, brent goose, etc. Formerly the game was hunted on open moors, stubbles, fens, and marshes, or in coverts, aided by spaniels and beaters; or else it was stalked on the hills (see Deer-Stalking), or along the shores of lakes and estuaries. This form or method still obtains in Continental Europe, the modern English method being the exception. In consequence of improved methods of agriculture, shooting over dogs in England and parts of Scotland and Ireland has become practically a thing of the past, and the 'drive' or *battue* has, of necessity, become the vogue. In America dogs may be regarded as a necessity. Many rules have developed for the guidance of sportsmen when shooting together in the field, some of the more important of which may be mentioned. Where two persons are shooting together it is the rule for one not to shoot at a bird which is flying toward his companion. It is very necessary to condemn the firing across a comrade's face; and good fellowship demands that a bird should never be fired at if it is flying so that it must cross before a companion until he has failed with both barrels of his gun. Where the birds fly directly away from the sportsmen, shots are taken at them alternately unless several should rise at once, when it is permissible for each man to fire at the birds on his own side.

Snipe make their first appearance in springtime, and are usually found in meadows and salt marshes. The element of chance enters very largely into the sport of snipe-shooting, but the hunter accustomed to their habits will usually be successful. Windy weather, if the wind is not too high, is a favorable time. Among experienced gunners, jacksnipe is a great favorite, owing to the impossibility of formulating for it any fixed rule. No two snipe fly alike; one may flush at fifteen feet and another at fifteen yards; one may steady thirty yards away, another at forty, and another may not steady until clear out of range. *Woodcock.*—During the day these birds may be found seeking for food in marshy thickets. When disturbed they fly in a rising straight line as far as the top of the bushes, and then after making some little distance horizontally, they settle down by means of a number of quick zigzag movements. *Grouse.*—The two most important varieties are the ruffed grouse and the pinnated prairie-chicken. In common with the Canada grouse (spruce partridge), and the blue and sharp-tailed grouse of the West, they have stout bills, short feathered legs, and dark plumage. The bird is found in thick woods, and is greatly protected by its color, which is so much like that of the ground that it is frequently overlooked. It is very shy and wild, and frequently will run far ahead of the dogs, and eventually rise completely out of range. Sometimes they are hunted with dogs and shot after they have taken refuge in a tree, but the keen sportsman never shoots unless he can secure them on the wing. The ruffed grouse is the most cunning game-bird to be found in the Northern States. *Quail* is often called a partridge in the Southern States, and is popularly known as the Bob White. There are almost fifty varieties of the bird, all of which have practically the same conformation. They are found in the Eastern and Middle States, but are more abundant in the South and Southwest. They afford good sport and are more easily got at than grouse or woodcock. After the pointers or setters have flushed them they make a very swift flight, and unless the hunter can come up with them immediately they are raised, they are likely to get out of range. *Wild fowl* (in which general description are included swans and geese, and among the ducks canvasbacks, redheads, mallards, teals, pintail, and wood-duck) abound especially in the lakes of the Northern States, along the New Jersey coast, Delaware and Chesapeake bays, Currituck Sound, the Mississippi Valley, Puget Sound, the Willamette and Columbia rivers, and all the lakes and bays of the Northwest. They are very fond of wild rice and wild celery, and are frequently lured to waters in which they have no natural food by hunters who plant wild rice. They are hunted in a variety of ways, among which may be enumerated the following: The hunter may station himself concealed near a point over which they fly, and shoot them as they pass; or he may put out decoys (see DECOY); or he may steal upon them while they are feeding or resting. In the Chesapeake Bay particularly, and occasionally elsewhere, sink-boats are used, in which the gunners lie and shoot the birds as they fly over. Another method is to sink a box in the sand or shallow water in which the hunter lies as in a sink-boat. Another very successful way is to employ the trained Chesapeake Bay dog, which will run up and down the shore, and by its actions excite the curiosity of the birds, which, if they approach to satisfy their curiosity, are within easy range of the gun. This method is known as 'toling.' *Wild turkey* is hunted with or without a decoy call or whistle. They are easily tracked by their trail on the ground, and may be shot at their roosts if surprised at break of day. One of the hardest birds to secure is the *upland plover* or *Bartram's sandpiper*, which cannot be approached except by means of some trick. For instance, in Rhode Island it is frequently hunted from a carriage in which the huntsman hides while he is driven in gradually lessening circles around where the bird is supposed to be. He must, however, be ready to spring out and fire the moment the bird rises. Occasionally trained ponies are used in much the same way as the carriage, the huntsman being concealed by the animal's fore legs and shoulder. Another method is to build a house of boughs and wait for the birds to alight in its vicinity. The *rail*, or ricebird, as it is known in the South, is usually hunted from boats at flood tide—a method which demands considerable skill and experience on the part of the man who manipulates the boat. Although they fly very slowly and are within the capacity of an indifferent shot, they must be killed at the first shot, or they will dive, and in a majority of instances be entirely lost. *Cranes* are hunted in the Mississippi Valley, their plumage being the principal attraction.

The hunting of game animals, as the lion, tiger, leopard, etc., will be found treated under the titles by which they are described. (For the fox, see FOX-HUNTING.) *Bears* are still found throughout the United States, but owing to the increasing proximity of man, and the increased employment of arms of precision, they have become exceedingly wary, and in many instances even timid. They may be found in the Catskill and Adirondack mountains in the East, the mountains of North Carolina and West Virginia, and in South Carolina, Mississippi, Georgia, Florida, Arkansas, and the mountains and forests of the West. They are hunted with rifles, and by the aid of dogs. *Hunting the hare* with beagles (q.v.) is a very popular sport in England, partly for the exercise it affords, and partly for its economy, in that horses are not required. The following list gives the charge and gauge of shotgun suitable for the various kinds of game-birds. Larger and wild animals are usually shot with a rifle, for which see SMALL ARMS. The first figure after the name of the bird has reference to the gauge, and the second figure to the size and kind of shot: Sora, rail, etc., from 12 to 20; 10 trap. Woodcock, 10 and 12; 10 shot. Snipe, 10 and 12; 9 shot. Quail, 10 and 12; 8 trap. Prairie-chicken, 10 and 12; 8 shot. Ruffed grouse, 10 and 12; 7 trap. Squirrel, 10 and 12; 6 shot. Teal, 10 and 12; 7 shot. Pintail, 10 and 12; 6 shot. Mallard, 10 and 12; 5 shot. Redhead, 10 and 12; 4 shot. Canvasback, 10 and 12; 3 shot. Turkey, 10 and 12; 2 shot. Goose, 10 and 12; BB.

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HUNTING CAT, or HUNTING LEOPARD. See CHEETA.

HUNTING DOG. This interesting animal (*Lycaon pictus*), which inhabits all the more open parts of Africa south of the Sahara and Abyssinia, is an aberrant species of dog, distinguished from the typical Canis by having four toes on each foot, and other structural peculiarities. It is about as tall as a greyhound, its legs being relatively long and slender, and adapted to the swift and enduring speed upon which it must depend for a livelihood. The head is broad and flat, with a short muzzle armed with massive teeth, rather large upstanding furry ears, and a suggestion of the hyena in the physiognomy; hence it is sometimes called 'hyena-dog,' though the likeness (even to the spotted hyena) is wholly superficial. (See Plate of WOLVES AND DOGS.) The fur is short, thick, and smooth, and grows more shaggy about the cheeks and throat; and the tail is long and wolf-like. In general color this dog is yellowish gray, but it is marked most irregularly with a variety of colors, such as a combination of red, white, yellow, and black spots, so that the hyena-dog may be regarded as the most particolored of all mammalia. In the southern Sudan, where the animals are plentiful, Schweinfurth saw one specimen that was perfectly tame, required no other restraint than a cord, and yielded to its master with all the docility of an ordinary dog. This fact appears to corroborate the assertion of Livingstone that the natives of the Kalahari desert are accustomed to break in this animal and train it for the chase.

To the Africans generally, however, both white and black, the hyena-dog was one of the most truly wild and dangerous animals of the country, taking the place of the wolves of the northern part of the world. They gathered into packs, and astonished and terrified the early settlers and explorers by their numbers, audacity, and strange cries. They frequented mostly plains and scantily forested or brushy regions, where the small antelopes abound, which were their principal prey, and which they would pursue in concert, often only two working together, until the baffled victim (often of the larger species) was cornered or exhausted and might be pulled down. They were a terrible scourge to the sheep and goats of the early frontier farmers, and killed or mangled many more of the flock in one of their nocturnal forays than they could possibly eat. The war waged against them in consequence, and the diminution of the wild game, has caused a great decrease in their numbers; but numerous bands still range the wilds of East and Central Africa, and the deserts west and north of Cape Colony. Consult: for early history of the animal, the books of Livingstone, Gordon-Cumming, Moffat, Harris, and their contemporaries; and for later facts, Schweinfurth, *Heart of Africa*, translated (London, 1873); Selous, *A Hunter's Wanderings* (London, 1890). See DOG.

HUNT'INGDON. The capital of Huntingdonshire, England, on the Ouse, 17 miles south of Peterborough (Map: England, F 4). It is celebrated as the birthplace of Oliver Cromwell, the entry of whose birth is to be seen in the register of Saint John's Church. The grammar school, founded in 1260, where he was educated, has been restored. Of Saxon origin, the town was the seat of a royal castle built in 919. Huntingdon received its charter of incorporation in 1189. A fine bridge erected in the thirteenth century connects it with Godmanchester. Population, in 1891, 4350; in 1901, 4260.

HUNTINGDON. A borough and the county-seat of Huntingdon County, Pa., 98 miles west of Harrisburg; on the Juniata River, and on the Pennsylvania Railroad (Map: Pennsylvania, C 3). It is the seat of Juniata College (German Baptist Brethren), opened in 1876, and of the State Industrial Reformatory. The city is in an agricultural and fruit-growing section with valuable forests and deposits of iron, coal, fire-clay, and limestone, and has manufactures of flour, machinery, stationery, sewer-pipe, boilers, radiators, furniture, and knit goods. Huntingdon was settled about 1760 on the site of a famous Indian council ground, now marked by a 'Standing Stone Monument,' erected at the borough centennial. The government is administered under the original charter of incorporation, adopted in 1796, which provides for a chief burgess, chosen every three years, and a council elected at large. Population, in 1890, 5729; in 1900, 6053.

HUNTINGDON, HENRY HASTINGS, Earl of (1535-95). An English noble, leader of the Protestant party, son of Francis Hastings, the second Earl, whom he succeeded in 1561. He was an intimate of Edward VI., who knighted him in 1548; and, through his mother's descent from George, brother of Edward IV., claimed after Elizabeth the succession to the crown. Especially in 1562, during her severe illness, he was considered as her probable successor. He hotly opposed the scheme to marry Mary Stuart to Norfolk, and was intrusted by Elizabeth to see that the Scotch Queen did not escape at the time of the threatened uprising in 1569. In the same year he was one of the council which considered the evidence against Mary; helped try Norfolk in 1573; and was prominent and active in the preparations of 1588 for the Spanish invasion.

Huntingdon was a zealous Puritan in sympathies, possibly for political reasons. He was succeeded by his brother, George.

HUNTINGDON, Selina Hastings, Countess of (1707-91). One of the most influential promoters of the early Methodist movement. She was the second of three daughters of Washington Shirley, second Earl Ferrers, and was born at Stanton-Harold, Leicestershire, August 24, 1707. She married, in 1728, Theophilus, ninth Earl of Huntingdon. She adopted the principles of the Methodists, much to the dismay of her friends, and gave her life with increasing zeal as the years went on to the interests of the new sect, introducing its ideas into aristocratic circles, to which its other adherents had no access. She was an intimate friend of both Wesleys, of Whitefield, and of many other clergymen prominent in her time. She became a widow in 1746. In the dispute between the Wesleys and Whitefield she sided with the latter, and assumed a leadership among his followers, who came to be known as 'The Countess of Huntingdon's Connection.' For the education of ministers she established and maintained a college at Trevecca, in Wales (removed, in 1792, to Cheshunt, Hertfordshire), and built, or became possessed of, numerous chapels in different parts of the country, the principal one being at Bath. She likewise expended large sums in the support of young men trained to itinerant preaching, as well as in private charity. She died in London, June 17, 1791. By her will she created a trust bequeathing her chapels to four persons for their care and management after her death. The number of these chapels was then sixty-four, of which about half still survive. Consult *The Life and Times of Selina, Countess of Huntingdon* (London, 1839-40).

HUNTINGDONSHIRE. A south-midland county of England, bounded on the east by Cambridgeshire, on the south by Bedfordshire, and on the west and north by the County of Northampton. Area, 366 square miles, almost the whole of which is in arable or pasture lands (Map: England, F 4). Population, in 1891, 57,760; in 1901, 57,770. It is watered chiefly by the Ouse and by the Nene, which skirts its northern boundary. The northern portion of Huntingdonshire is included in the great fen-country. The soil is various; clay, however, predominates generally. Grain, beans, rape, and clover are the chief crops. Capital, Huntingdon.

Huntingdonshire was traversed by two Roman roads, and Roman remains, as coins, pottery, etc., have been found. In early Anglo-Saxon times it belonged to East Anglia, afterwards to Mercia.

HUNTINGTON. A city and the county-seat of Huntington County, Ind., 24 miles southwest of Fort Wayne, on Little River, and on the Wabash and the Chicago and Erie railroads (Map: Indiana, D 2). It has a United Brethren college and a public high-school library with 11,000 volumes. There are railroad shops of the Chicago and Erie, numerous lime-kilns and wood-working establishments, and manufactures of boots and shoes, pianos, bicycles, etc. The city has also important commercial interests. Settled in 1834, Huntington was incorporated as a town in 1848, and in 1873 was chartered as a city. Under the charter of 1873, the government is vested in a mayor, elected biennially, and a city council. The water-works and electric-light plant are owned and operated by the municipality. Population, in 1890, 7328; in 1900, 9491.

HUNTINGTON. A town, including several villages in Suffolk County, N. Y., 30 miles east by north of New York City, on Long Island Sound and on the Long Island Railroad (Map: New York, G 5). It is in a fertile agricultural district and has manufactures of brick and pottery, but is primarily a residential suburb of New York and a popular summer resort. There are a public library of 3500 volumes and a monument marking the spot where Nathan Hale was captured. The government is administered by town meetings, which are held biennially. Population, in 1890, 8277; in 1900, 9483.

HUNTINGTON. A city and the county-seat of Cabell County, W. Va., 52 miles west of Charleston, on the Ohio River, and on the Chesapeake and Ohio, the Ohio River, and the Guayandotte Valley railroads (Map: West Virginia, B 3). It is picturesquely situated and well laid out, and has Marshall College (State normal school), the West Virginia Asylum for Incurables, and a Carnegie Library. The city controls an important commerce, and has several wholesale establishments, shops of the Chesapeake and Ohio Railroad, an extensive car-manufacturing concern, a steel plant, machine-shops, a brewery, and manufactures of glass, picture-frames, stoves, etc. Settled and incorporated in 1871, Huntington is now governed under a charter of 1895, revised in 1901, which provides for a mayor, elected every two years, and a unicameral council. Population, in 1890, 10,108; in 1900, 11,923.

HUNTINGTON, Daniel (1816—). An American historical, genre, and portrait painter. He was born in New York, October 14, 1816, and was educated at Hamilton College. In 1835 he studied with Professor Morse, and later with Inman and Trumbull; in 1839 he visited Italy, studying with Ferrero in Rome. On his return to America he became a resident of New York. He was elected member of the National Academy in 1840, and held the office of president from 1862 to 1869, and from 1877 to 1891. He returned to Europe in 1854, and painted several important works at Florence and Rome.

His pictures are illustrations of taste rather than elaborate painting; his color is subdued but good, and his style is unaffected. He has been chiefly engaged in portrait painting, but he has also painted historical and genre works of note. Two of his largest canvases are "Lady Washington's Reception Day" and the "Atlantic Cable Projectors," in the Chamber of Commerce, New York, both containing exceptionally fine portraits. His other principal works are: "Florentine Girl" (1839); "Shepherd Boy" (1840); "Sacred Lesson" (1844); "Mercy's Dream" (1850), in the Corcoran Gallery, Washington (a replica in the Pennsylvania Academy, Philadelphia); "Henry VIII. and Catharine Parr" (1850); "Venice," owned by J. P. Morgan, New York; "Study in the Woods," owned by C. P. Huntington, New York; "The Sibyl," Historical Society, New York; "Republican Court" (1876), Stuart Collection, New York; "Philosophy and Christian Art" (1878). Among his portraits are those of Presidents Lincoln, Union League Club, New York; Van Buren, State Library, Albany; Gov. E. D. Morgan, William E. Dodge, Chancellor Ferris, New York University; Mr. and Mrs. Taylor, Corcoran Gallery, Washington; Bishop Whipple, Rev. Morgan Dix, Bishop Potter; Judge Blatchford (1879), United States District Court; Gen. John A. Dix (1880), Historical Society, New York; Hon. John Sherman (1881), Chamber of Commerce, New York; Rev. Dr. Adams (1883), Union Theological Seminary, New York; Hon. R. C. Winthrop, United States Congress; Julius Hallgarten, founder of prizes of the National Academy.

HUNTINGTON, Frederick Dan (1819-1904). An American clergyman, the first Protestant Episcopal Bishop of Central New York. He was born at Hadley, Mass.; graduated at Amherst in 1839, and at Harvard Divinity School in 1842, and was pastor of the South Congregational (Unitarian) Church, Boston. In 1855 he became preacher at Harvard and Plummer professor of Christian morals there. In 1860 he left the Unitarian Church to become an Episcopalian. Resigning his professorship, he organized a parish in Boston, and was its rector until 1869, when he was consecrated Bishop of the newly created Diocese of Central New York. Among his numerous works are: *Lectures on Human Society* (1860); *Memorials of a Quiet Life* (1874); *Christ in the Christian Year* (2 vols., 1877-81); and *The Golden Rule Applied to Business and Social Life* (1892).

HUNTINGTON, Jabez Williams (1788-1847). An American jurist and legislator. He was born in Norwich, Conn., graduated at Yale in 1806, studied and practiced law in Litchfield, Conn., was a representative in Congress from 1829 to 1834, was then a judge of the highest courts in Connecticut, and was finally United States Senator from 1840 until his death.

HUNTINGTON, Jedidiah (1743-1818). An American general in the Army of the Revolution, born in Norwich, Conn., the son of Jabez Huntington (1719-1786). He graduated at Harvard in 1763, joined the American Army at Cambridge, became a brigadier-general in 1777, and took part in many important engagements until the close of the war, when he was brevetted major-general. He was one of the organizers of the Society of the Cincinnati. He became collector of the port of New London in 1789, and held the office twenty-six years.

HUNTINGTON, Samuel (1732-96). An American lawyer and signer of the Declaration of Independence. He was born at Wyndham, Conn., on a farm, educated himself for the law; practiced at Norwich, represented that constituency in the General Assembly, and became associate justice of the Superior Court (1774), of which, ten years later, he became Chief Justice. From 1776 to 1784 he was a member of the Continental Congress, of which he was president, as the successor of John Jay, in 1779-80. From 1786 to his death, Huntington was Governor of Connecticut. His nephew and adopted son, Samuel Huntington (1765-1817), graduated at Yale in 1785, was admitted to the bar in 1793, and in 1801 removed to Cleveland, Ohio. He passed the rest of his life in that State, and held the offices of Judge of the Superior Court, Chief Justice of the Supreme Court, State Senator, and Governor of the State from 1808 to 1810.

HUNTINGTON, William Henry (1820-85). An American journalist, born at Norwich, Conn. He spent most of his life in Paris, where for twenty years he was a correspondent of the New York *Tribune*. He remained in Paris during the siege of 1870-71, engaged in the relief of the suffering. His remarkable collection of portraits of Washington and Franklin was given to the Metropolitan Museum of Art.

HUNTINGTON, William Reed (1838—). An American clergyman, of the Protestant Episcopal Church. He was born in Lowell, Mass., graduated at Harvard in 1859, and became an instructor in chemistry there. Entering the Episcopal ministry, he was rector of All Saints Church, Worcester, Mass., in 1862-83, and of Grace Church, New York, after 1883. Dr. Huntington always took a prominent and influential part in public affairs. In his own communion he was active in the movement for liturgical revisions, and was long chairman of the Prayer-Book Revision Committee, and joint editor with Dr. Samuel Hart of the *Standard Prayer-Book* of 1892. In addition to sermons, his publications include: *The Church Idea, an Essay Toward Unity* (1870); *Conditional Immortality* (1878); *The Book Annexed, Its Critics and Its Prospects* (1886); *Short History of the Book of Common Prayer* (1893); and *A National Church* (1898).

HUNT′LY, George Gordon, fifth Earl of (?-1576). A Scottish statesman. He was educated for the Church, but gave up the idea of entering it upon the death of his elder brother, and became Sheriff of Inverness and the keeper of its castle (1556). Entering into the political plots of his time, he was more than once imprisoned and condemned to death. Mary, Queen of Scots, released him and restored his estates and title, with a view to gaining his adherence; but he refused to turn Catholic to please her, though he sided with his brother-in-law, Bothwell, in the troubles that followed. Huntly tried to rescue Rizzio, and was a main mover in the murder of Darnley as well as in the Queen's subsequent marriage to Bothwell, to which he was a witness. He conspired to rescue his royal mistress from Lochleven (1568), and raised troops in her service; but his lifelong enemy, the Earl of Moray, vanquished him at last, and Huntly's resolve to give up her cause as hopeless was Mary's chief reason for surrendering to Elizabeth.

HUNTS′VILLE. A city and the county seat of Madison County, Ala., 100 miles north of Birmingham, on the Memphis and Charleston and the Nashville, Chattanooga and Saint Louis railroads (Map: Alabama, C 1). It is in the fertile valley of the Tennessee River, and has important farming, cotton-growing, and stock-raising interests. There are cotton-mills, a foundry and machine-shops, saw-mills, sash and blind factories, etc. Among the educational institutions are the Huntsville Female College, Huntsville Female Seminary, a State normal and industrial school, and the Central Alabama Academy. The government, as provided by a charter of 1898, is vested in a mayor, elected biennially, and a council which controls appointments to all administrative departments. The city owns and operates its water-works. Settled in 1775, Huntsville was first incorporated in 1800. At one time it was the capital of the State. Population, in 1890, 7995; in 1900, 8068.

HUNTSVILLE. A city and the county-seat of Randolph County, Mo., seven miles west of Moberly, on the Wabash Railroad (Map: Missouri, D 2). It has coal-mines and some manufactures, and a trade in coal, farm produce, live stock, etc. Population, in 1890, 1836; in 1900, 1805.

HUNTSVILLE. A city and the county-seat of Walker County, Tex., 75 miles north of Houston, on the International and Great Northern Railroad (Map: Texas, G 4). It is an important cotton market, and manufactures cotton goods, cottonseed oil, wagons, furniture, steam-engines and boilers, cigars, etc. The city has the Sam Houston Normal School (State), the State Penitentiary, and, of historic interest, the old home and grave of Gen. Sam Houston, and the grave of H. Yokum, the first historian of Texas. Huntsville was first settled about 1836. The government is administered by a mayor, elected every two years, and a unicameral council. Population, in 1890, 1509; in 1900, 2484.

HUNYADY, hụn'yŏ-dĭ, JÁNOS (John Hunniades) (c.1387-1456). The national hero of Hungary. His origin is shrouded in obscurity. He saw his first military service under King Sigismund. Under Sigismund's successor, Albert II. (1438-39), he became known as a brilliant soldier, and was ban of a district on the borders of Transylvania, exposed to the Turkish attacks. It was the period when the Turkish power was at its height, and it seemed within the range of possibility that the Mohammedans would obtain possession of the greater part of the Danube Valley and seriously menace Western civilization. To Hunyady, more than to any other one man, Europe owes it that the danger was averted. Albert died in 1439, and as there was no male heir, the nobles elected King Ladislas, of Poland, to the Hungarian throne. Meanwhile the wife of Albert gave birth to a son, Ladislas Posthumus, and a civil war resulted, of which the Turks took advantage. Hunyady, however, defeated them in several battles, and in 1443 an advantageous peace was made. Nevertheless, King Ladislas, incited by the Papal Legate, Julian Cesarini, began war again, and on November 10, 1444, the Hungarian army under Ladislas and Hunyady was overwhelmed at Varna. Ladislas was among the slain, whereupon Ladislas Posthumus was recognized by all parties as King, and Hunyady was made Regent during the minority. War was actively carried on both against the Turks and Frederick III. In 1448 Hunyady was completely defeated by the Turks at Kossovo, after which he was held prisoner for a short time by the Servians. His most splendid achievement was the defense of Belgrade in 1456 against the army of Mohammed II., the conqueror of Constantinople, in which he was aided by the celebrated Giovanni Capistrano (q.v.). On June 15, 1456, the Turkish attack began, and on July 14th Hunyady forced his way into the city, while Szilágyi, the commander of the town, made a sortie, and finally, on July 21st, the Turks were decisively repulsed and raised the siege, having lost 80,000 men. A few days after this glorious victory dysentery broke out in the army, and Hunyady, the great Christian hero, after a short illness, fell a victim to the disease. He left two sons, Ladislas and Matthias Corvinus. The former was treacherously imprisoned and beheaded at Buda, by Ladislas Posthumus. Matthias, generally known as Matthias Corvinus, became King of Hungary in 1458. Consult Chassin, "Jean de Hunyad," in *La Hongrie* (Paris, 1856).

HUNZAS, hōōn'zȧz. One of the Aryan tribes of Dardistan, inhabiting the district about Hunza.

HUON DE BORDEAUX, ụ'ôɴ' de bôr'dō'. A French *chanson de geste*, probably belonging to the thirteenth century, and then somewhat altered when rewritten for Charles Seigneur de Rochefort, early in 1454. The oldest printed edition is in folio and without date; the second, in quarto, bears the date 1516. The English translation was made by Lord Berners, in Henry VIII.'s time. The subject has proved a tempting one for poets, the famous *Oberon* of Wieland, and Weber's opera of the same name, being among the poems founded upon it, while Shakespeare drew from it in the *Midsummer Night's Dream.* A prose adaptation has been issued by Gaston Paris (1899).

HU'ON PINE. See DACRYDIUM.

HUPA, hōō'pȧ. A tribe of Athabascan stock, originally occupying a number of small villages on the lower Trinity River, California, and now gathered on the Hupa Valley Reservation in the same region. Like some of the stock, they were formerly of warlike and aggressive character, and are said to have brought a number of surrounding tribes under regular tribute, besides compelling them to a certain extent to use their language. In their pristine condition, they subsisted chiefly upon salmon, dried and smoked, and acorns made into flour and porridge. They were noted for the variety and beauty of their basketry. They now number 420, not including some remote tribes.

HU-PEH, hụ'pĕ (Chin., Lake North). One of the eighteen provinces of China proper, situated in the very centre of the country, and surrounded by the populous and important provinces of Hu-nan on the south, Sze-chuen on the west, Shen-si and Ho-nan on the north, and Ngan-hwei on the east. The Yang-tse from west to east runs through its southern part, while the Han, in its tortuous course from the northwest, irrigates its fields and provides a splendid waterway for its commerce. The province is mountainous in the north, being penetrated with spurs and outlines from the Ta-pa-shan and Fu-niu mountains. Toward the southwest it is low-lying, and is covered with many marshes, shallow lakes, and lagoons, the remains of that portion of the Tung-ting Lake which formerly spread much farther north than it does now. These sheets of water have been connected by navigable ditches, and serve as a safe short cut for the smaller class of native junks from Sha-shi (on the Yang-tse opposite the entrance to the Tung-ting) to Hankow, or to towns farther up the Han.

The area of the province is estimated at 70,000 square miles, and its population at 28,300,000. For administrative purposes it is divided into 10 fu, or departments, 1 sub-department, 60 hien (or hsien) or prefectures, and 10 subprefectures. The capital is Wu-chang, on the Yang-tse, opposite Hankow, where the Futai or Governor of the province, and the Tsung-tuh or Governor-General of the united provinces of Hu-nan and Hu-peh reside. Three of the towns are treaty ports—Hankow, Sha-shi, and I-chang (qq.v.)—all on the left bank of the Yang-tse, There are several extensive coal-fields in the province, and both coal and iron are now being actively mined by modern methods.

HUPFELD, hōōp′fĕlt, Hermann (1796-1866). A German theologian and Orientalist. He was born in Marburg, studied at the university there, was professor from 1825 to 1843, and in the latter year succeeded Gesenius at Halle. His most important work is the *Uebersetzung und Auslegung der Psalmen* (1855-61), characterized by sound scholarship. His further publications include: *Exercitationes Æthiopicæ* (1825); *Die Quellen der Genesis* (1853); and *Die heutige theosophische und mythologische Theologie und Schrifterklärung* (1861). Consult Riehm, *Dr. Hermann Hupfeld* (Halle, 1867).

HURA, hū′rȧ (Neo-Lat., from the native name). A genus of plants of the natural order Euphorbiaceæ. *Hura crepitans*, a native of the West Indies and tropical America, is a tree which abounds in a very acrid milky juice, and has stalked, heart-shaped, acuminate, leathery leaves. The fruit is a woody capsule, of the size of a large apple, very much flattened, formed of 12 to 15 carpels, each containing a large seed. These carpels surround a common axis, and separate with great elastic force. The tree is called sandbox-tree, because, before the use of blotting-paper became general, the capsule was generally used in the West Indies as a sandbox for powdering letters with fine sand; but it was found necessary to bind it with a hoop of iron, as, even after being used for years, it would sometimes burst with a loud report. The seeds are a violent drastic purgative.

HU′RAM. See Hiram.

HURD, Richard (1720-1808). An English prelate. He was born at Congreve, in Staffordshire, January 13, 1720; studied at Cambridge University, and became fellow of Emmanuel College in 1742. In 1749 appeared anonymously his first notable production, *Commentary on Horace's Ars Poetica*, in which he advocated the now discredited theory that the poem was a systematic criticism of the drama of the Romans. In 1750, on Warburton's recommendation, he was appointed one of the Whitehall preachers. He became Bishop of Lichfield and Coventry (1775), and in 1783 declined the Archbishopric of Canterbury. He died at Hartlebury Castle, May 28, 1808. His principal works are: *Moral and Political Dialogues*, in which historic characters are introduced as interlocutors on such themes as sincerity, retirement, the golden age of Elizabeth, and the constitution of the English Government (1759); *Letters on Chivalry and Romance* (1762); and *An Introduction to the Study of the Prophecies Concerning the Christian Church, and Particularly Concerning the Church of Papal Rome* (1772). His complete works with life appeared in eight volumes (London, 1811). Consult, also, his life by F. Kilvert (ib., 1860).

HURDWAR, hẽrd-wär′. See Hardwar.

HURDY-GURDY (of onomatopoetic origin). A very old musical instrument of the stringed kind, which, under the name of leyer, or Bauernleier, spread from its native country, Germany, over a great part of Europe. The hurdy-gurdy consists of a flat, oval-shaped sounding-board, over which the strings are stretched, with a back or bottom of the same size and shape. These are bound together by tolerably deep sides, or ribs. On one side are from ten to twelve finger-keys, for shortening the sounding lengths of the strings when required. There are four strings of gut which are put into a state of vibration by being rubbed by the edge of a small wooden wheel charged with rosin, and turned by a handle. Two of the strings are tuned in unison as a key-note, or one of them a fifth above; they are placed out of reach of the keys, and form a sort of drone-bass. The other two strings are acted on by the keys, and produce a diatonic scale of from ten to twelve notes. The hurdy-gurdy is only suited to simple music, and was used for such as had many repetitions. From the tenth to the twelfth century it was one of the most popular instruments, but was then superseded until the eighteenth, when it again, and especially in France, became very popular. It is now nearly obsolete. The name is also applied to a large street or barrel organ (q.v.). For illustration, see Musical Instruments.

HURL′BUT, Jesse Lyman (1843—). An American clergyman of the Methodist Episcopal Church. He was born in New York City; graduated at Wesleyan University in 1864, and held several pastorates in New Jersey. After 1879 he was connected with the Sunday-school and tract work of his denomination, spending much of his time as an editor of Sunday-school literature. He was secretary of the Epworth League in 1889-92, and for some time was associated with Dr. J. H. Vincent in the direction of the Chautauqua Literary and Scientific Circle. Among his works are: *Manual of Biblical Geography* (1882); *Outlines in Old Testament History* (1890); and *Our Church* (1903).

HURLBUT, Stephen Augustus (1815-82). An American soldier and diplomat, born in Charleston, S. C. He studied law, was admitted to the bar in 1837, and practiced in Charleston until 1845, when he removed to Belvidere, Ill. He was a Whig member of the Illinois State Constitutional Convention in 1847, served as a Whig Presidential elector in 1848, was in the State Legislature from 1859 to 1861, and in May, 1861, became a brigadier-general of volunteers. He commanded a division at Fort Donelson, after its capture, and at Shiloh; was promoted to be major-general of volunteers in 1862; commanded the Sixteenth Army Corps during Sherman's Mississippi campaign of 1864 and succeeded General Banks as head of the Department of the Gulf. He was returned to the Illinois Legislature in 1867, and was a Republican Presidential elector in 1868. From 1869 to 1872 he served as United States Minister to Colombia, was a member of Congress from 1873 to 1877, and in May, 1881, he was appointed United States Minister to Peru, where he died the following year.

HUR′LEY. The county-seat of Iron County, Wis., 40 miles east by south of Ashland, on the Montreal River, opposite Ironwood, Mich., and on the Wisconsin Central and the Chicago and

Northwestern railroads (Map: Wisconsin, C 2). It is in the productive Gogebic iron-mining district, several large mines being in the vicinity, and is engaged to some extent also in lumbering, farming, and stock-raising. Population, about 2000.

HURLING. A field sport, akin to the more modern game of hockey (q.v.). It is played to-day on a field 140 × 84 yards, with goals at each end, the posts of which are 21 feet apart and a cross-bar 8 feet high, and two point-posts 21 feet on each side of the goal-posts. The field is lined across, parallel with the goals, at 21 and 50 yards, and half-way down. The hurley-stick approximates to the ice-hockey stick in shape, but is held with the left hand below the right. The ball, or 'stiller,' is of cork, wound round with woolen threads and covered with leather. It is 5 inches in diameter and weighs 7 ounces. Play is begun by the 14 players on each side facing each other in the centre of the field. The referee then throws the ball between the two lines of players, who thereupon scatter to their respective positions in the field. The object of the players is to drive the ball through the space between their opponents' goal-posts. If the ball passes over the side line, previously appointed sidesmen throw it back into play. The use of the hands is barred, though in a scrimmage a moderate use of the feet is tolerated. There are some very pretty strokes made with the hurley, notably that where the ball is raised in the air with the point and hit forward as it falls.

HURLOTHRUMBO. An operatic burlesque, written by one Samuel Johnson, a Cheshire dancing-master, in 1723, and produced at the Haymarket, April, 1729, the author himself taking the part of Lord Flame. Its prologue was written by Amos Meredith, and the epilogue by John Byrom. It was published by subscription, with a dedication to Lady Delves, in 1730, and a second edition, addressed to Lord Walpole, appeared the ensuing year. It was bitterly satirized by Fielding's *The Author's Farce* (1729).

HURON, hū'rŏn. A city and the county-seat of Beadle County, S. D., 120 miles east of Pierre; on the Great Northern and the Chicago and Northwestern railroads (Map: South Dakota, G 5). It is a division headquarters of the Chicago and Northwestern Railroad, with machine-shops, roundhouses, etc., and has flour-mills and grain-elevators, carriage and wagon shops, a brick-yard, a creamery, and other industries. Population, in 1890, 3038; in 1900, 2793.

HURON. An Indian tribe. See WYANDOT.

HURÓN. The name of certain animals of the family Mustelidæ. See GRISON.

HURON, LAKE. One of the five Great Lakes on the northern frontier of the United States, lying between Lake Superior on the northwest and Lake Erie on the southeast, connected with Lake Michigan on the west, and bounded on the southwest by Michigan and on the north, east, and south by the Province of Ontario (Map: United States, J 2). It is the third in size of the Great Lakes, having a total area of 22,322 square miles, and being about 250 miles long and 190 miles wide. A large arm of the lake in the east, extending far into Ontario, is known as Georgian Bay. Lake Huron receives the waters of Lake Superior through the Saint Mary's River, and those of Lake Michigan through Mackinaw Straits. Its outlet is the Saint Clair River, flowing into Lake Saint Clair, which is connected by Detroit River with Lake Erie. The general direction of the lake lengthwise is from north-northwest to south-southeast. The surface is 9 feet above the level of Lake Erie, 335 feet above Lake Ontario, and 582 feet above the sea, with occasional fluctuations as in the other lakes. Its depth varies from 200 to 700 feet. The waters are very clear and cold, especially in the northern part, and abound in fish, of which the whitefish is the most important. There are few harbors on the west side, but vessels find shelter in Saginaw Bay, about 70 miles north of the outlet, and also in Thunder Bay, as much farther north. Presque Isle is also a fair harbor, and there is good shelter under the south side of the island of Mackinaw. The lake is subject to violent storms, but navigation is safe from May 1st to December 1st. Mackinaw has long been an important post for fur trade with the Indians. Bay City, at the head of Saginaw Bay, is an important lumber depot, and copper-mines have been opened in the upper portions of Manitoulin Bay. Excellent grindstones are cut from the sandstone near Thunder Bay. The main body of water is unbroken by islands, but there is a group of islands in the north, most of them belonging to Canada, the largest of which is Grand Manitoulin. There is much geological evidence to the effect that Lake Huron was formerly deeper and more extensive than at present. See GREAT LAKES.

HURONIAN SERIES. See PRE-CAMBRIAN FORMATIONS.

HURRICANE. See STORM; WIND.

HURRUR. See HARRAR.

HURST, JOHN FLETCHER (1834-1903). A Methodist Episcopal bishop and author. He was born in Dorchester County, Md., graduated at Dickinson College in 1854, and studied theology at the universities of Halle and Heidelberg. After his return to America he held a pastorate in New Jersey from 1858 until 1866. Again going to Germany, for three years he taught theology at the Mission Institute in Bremen, and Frankfort-on-the-Main, and then traveled extensively in Europe, Syria, and Egypt. In 1871 he was chosen professor of historical theology in the Drew Theological Seminary, Madison, N. J., becoming president of the institution two years later. In 1880 he was elected bishop, and has spent much time visiting missions and conferences in Europe and India. In 1891 he was chosen chancellor of the American University, Washington. He translated several theological works from the German, and wrote numerous works on Church history, including a *History of Rationalism* (1865); *Martyrs to the Tract Cause* (1873); *Our Theological Century* (1876); *Bibliotheca Theologica* (1883); and a *History of the Christian Church* (1897-1900).

HURTADO, o͝or-tä'dō, LUIS DE TOLEDO (c.1530-c.1589). A Spanish poet and romancer, born at Toledo. He was the author of *Palmerin de Inglaterra* (1547), a famous romance which ranks next to *Amadis of Gaul*. It was exceedingly popular, and was immediately translated into French, Italian, and Portuguese. Hurtado also wrote: *Tragedia Policeana* (1548); *Comedia de Preteo y Tibaldo* (1552); and *Egloga selviana*

(1553), a pastoral comedy. Consult the study by Vasconcellos (Halle, 1883).

HURTADO DE MENDOZA, dâ mân-dō′thâ, GARCIA, Marquis of Cañete (1535-1609). A Spanish soldier and administrator, born at Cuenca. He fought in Italy and Germany, but by 1557 was Governor of Chile, where he took part in the local wars. Three years afterwards he was back in Spain, whose battles he fought in Portugal, but he returned to South America as Viceroy of Peru in 1590. He sent out expeditions which resulted in the discovery of the Marquesas Islands, called after him; but he resigned his post in 1596.

HURTER, hōōr′tĕr, FRIEDRICH EMANUEL VON (1787-1865). A Swiss historiographer. He was born at Schaffhausen, and educated there and at Göttingen. He was pastor at Beggingen (1808), and at Löhningen, and in 1835 was made dean and antistes of the Reformed synod. After the publication of his *Geschichte Papst Innocenz' III. und seiner Zeitgenossen* (1834-42) he became a Roman Catholic (1844). At about the same time he published *Die Befeindung der katholischen Kirche in der Schweiz seit 1831* (1842-43)), and *Geburt und Wiedergeburt* (1845), an apologia for his conversion. In 1846 he settled at Vienna, and was made historiographer to the Emperor of Austria. Under the liberal rule of Pillersdorf he resigned this position, but was reappointed in 1851. His other historical works include: *Geschichte des ostgothischen Königs Theodorich* (1807); *Denkwürdigkeiten aus dem letzten Decennium des 18. Jahrhunderts* (1840); *Philipp Lang, Kammerdiener Rudolfs II.* (1851); *Zur Geschichte Wallensteins* (1855); and *Wallensteins vier letzte Lebensjahre* (1862). Consult Hurter (his son), *Friedrich von Hurter und seine Zeit* (Gratz, 1876-77).

HUSBAND AND WIFE. A man and woman married to each other. The modes of contracting marriage, with the accompanying ceremonies, and the impediments to marriage will be more properly described under the head of MARRIAGE (q.v.), and the mode of dissolving the marriage has been already described under DIVORCE (q.v.). The effects of marriage upon the rights of the parties and upon their property will here be described.

The effect of marriage at common law may be viewed under two heads: first, as regards the persons and the personal rights of the married persons, and, secondly, as regards their property. (1) AS TO THE PERSON. By marriage at common law the husband became legally bound to support the wife in a manner consistent with his resources and social position. He also became bound to pay all debts contracted by her before the marriage, and when sued with the wife became responsible for her torts committed either before or during the coverture. In all other respects he remained in precisely the same position as before marriage. Independently of his wife he could sue and be sued, enter into contracts, and bind himself as fully after as before marriage, and he could even make a will and bequeath all his property to strangers regardless of the wife. As regards the person and personal rights of the wife, however, there was a material difference. Her person is said to be merged in that of her husband, and for many purposes they were treated as one person in the eye of the law. The wife could neither sue nor be sued independently of the husband. Her contracts were void even when made with her husband. Even the personal property she had before marriage became her husband's absolutely, and he could dispose of it at will. She had no power to make a will of real estate, and her will disposing of personal property owned by her before her marriage could be effective only when authorized or consented to by the husband at her death. As the husband, however, was bound to support the wife, she had authority in law without his consent to pledge his credit for necessaries supplied by third persons. This obligation, being imposed by law, was not properly a contract, but a quasi-contract (q.v.). Necessaries are any articles of personal use, as food or wearing apparel, which are suited to the rank and position in life of the husband, and with which the wife is not provided. Therefore, if goods were ordered by the wife which were not necessary, the husband was under no legal liability to pay for them unless he expressly or impliedly ratified his wife's act in purchasing them. Thus he could not keep the goods and refuse payment. If, for example, he saw his wife wearing an expensive dress which he knew he did not himself order or pay for, and did not at once repudiate the purchase and return the goods, he would be held to have consented and approved of the purchase. Though the husband is bound to maintain his wife, there were, curiously enough, only circuitous means of enforcing this duty. The wife, for example, could not sue the husband herself, but having an implied authority to order necessaries, the tradesman so supplying them could sue the husband for the price. The wife also might impose liability on the husband by contract for articles not necessaries by virtue of an implied authority as agent of the husband to purchase such articles; thus, a husband might be liable to pay for articles such as he had regularly permitted his wife to purchase on his credit before, although he knew nothing of the particular purchase in question. See AGENT.

The husband, being entire master of his own actions, has the power to decide where to live, and the duty of the wife is to live with him in the same house. So long, then, as the husband and wife continue to live together, the domicile of the wife is determined by the domicile of the husband. If she ceases to live with her husband she may then acquire an independent domicile. If the wife lives apart from the husband without just cause he is not bound to support her even with necessaries. If, however, she separates from him for just cause, the liability of the husband for necessaries continues. There are, at common law, several just causes for her living apart from her husband. If the husband, for example, treats her with what is deemed cruelty in the eye of the law, as keeping a mistress in the house, or starving her, or assaulting her, she is entitled to leave him, and can order necessaries at his expense from any tradesman willing to supply her. There are, however, many degrees of cruelty and ill usage for which the wife has practically no remedy, and of which the law can take no cognizance. The statement frequently found in the early treatises that the husband has at common law the right to reasonably chastise the wife was probably without authority, and certainly has no support in modern law. The husband can enforce the wife's antenuptial contracts, and can recover for torts committed toward her either before or after the marriage by joining her with himself as plaintiff in an action. For torts resulting in loss of her services to him or requiring him to provide medical attendance or other necessaries he can recover in his own name and right. He may also recover damages from a third person for unlawful intercourse with his wife, and either husband or wife might recover damages from a third person for alienating the affections of the other. As regards crimes committed by a wife, she is in general liable to be punished for them in the same way as if she were unmarried. But there is a peculiarity as regards crimes committed by the husband and wife jointly in the husband's presence. If the crime be treason or murder, both are punished precisely as if they were unmarried. But in all the lesser crimes the theory, as well as the practice, is that if the wife was a party to the crime, and committed it in her husband's presence, she is presumed by the law to have so acted under the compulsion or coercion of her husband, and is acquitted as a matter of course. The presumption, however, is a presumption of fact only, and may be rebutted by showing that in fact the wife was not coerced by the husband; but in the absence of any direct evidence one way or the other on the subject of coercion it is presumed that the wife acted under this marital coercion, and so she escapes punishment. Another curious anomaly arising from the common-law maxim that husband and wife are one person is that the wife cannot be convicted of stealing her husband's goods. If she absconds with his property, however valuable, she cannot be punished. But this rule is qualified by the circumstance that if she commits adultery, and afterwards absconds with the adulterer, both taking away the husband's goods, the adulterer may be convicted of the larceny, though it is doubtful if she is in that case liable to any punishment. Where the third party does not have in view any adultery with the wife, but joins her in taking away the husband's goods, neither he nor the wife can be punished criminally.

At the common law also husbands and wives may be witnesses for or against other parties in all civil cases, i.e. actions and suits relating to debts, contracts, and wrongs which are not crimes, and in all inquiries of a civil nature. But neither can testify for the other in an action to which the other is a party; but either can be compelled by the opposite party to be a witness. In all cases neither husband nor wife can be compelled to disclose any confidential communication made to him or her by the other spouse during the marriage. As regards all criminal proceedings instituted against either husband or wife, the other spouse is neither competent nor can be compelled to be a witness; but where the husband and wife are not the accused, but are the prosecuting parties, then, inasmuch as the State is presumed to be the prosecutor, and the husband and wife are not parties, they may be both witnesses, subject to the qualification as to not being bound to disclose confidential communications made by and to each other during marriage. There is an exception also to the rule that neither can be a witness against the other in criminal proceedings—viz. where the wife charges her husband with an assault or other crime of greater degree upon her person, she is in that case only a competent witness against him, for otherwise the crime might go unpunished. Moreover, in all proceedings instituted in consequence of adultery of the husband or wife, neither of the married parties is competent or can be compelled to be a witness.

(2) AS TO THE PROPERTY OF THE MARRIED PERSONS. As regards the husband, he not only remains sole owner of his property, and, subject to the wife's right of dower, can do what he likes with it, but he becomes absolute owner of her personal property of every kind which is capable of being reduced to possession. As will be hereafter explained, he also becomes a qualified owner of her choses in action (q.v.) and her chattels real. The legal title of the wife's real estate remains in the wife, but she cannot convey it without the husband joining in the conveyance by fine and recovery, and the rents, issues, and profits of her real estate belong absolutely to her husband. Owing to the common-law rule that the husband is entitled to the services of the wife, he becomes entitled to her earnings acquired by rendering service to others. It will thus be seen that during the coverture the wife cannot, at common law, acquire any personal property, and her title to real property acquired before or after her marriage is subject to the rights of the husband, as stated. But as regards the wife the case is different. The old rule as to the wife's personal property becoming the husband's absolutely after marriage suffered qualification when such property consisted not of money or chattels, but of what are called chattels real, such as leases and mortgages. (See CHATTELS.) In such a case they become so far the property of the husband that he can sell them during his life, but he cannot bequeath them by will; and on his death they remain hers, while on her death they become his. Again, where the wife's personal estate before marriage consists of mere rights of action, or debts due to her, they become so far his that he can at any time sue for them, and so reduce them into possession, and make them his own absolutely; but he cannot bequeath them by will, and if he does not sue for them in his lifetime they survive to the wife after his death. As regards the wife's real estate—i.e. her lands and houses held in freehold—the husband does not acquire any legal interest in the title by the marriage, but, as has been pointed out, he acquires the right to the rents, issues, and profits, and consequently the right to dispose of the real estate during the coverture; and, if the wife bear him a living child, upon her death he becomes entitled to a life interest in her real estate, known as tenancy by the curtesy (q.v.). Upon marriage the wife also acquires an inchoate right to dower in real estate of which the husband may be seized or which he may thereafter acquire—that is, a life estate or interest in one-third of all such real estate. This right becomes complete only upon death of the husband before the wife, but it cannot be impaired by any act of the husband during the coverture or by the wife herself except by joining with her husband in a conveyance by fine and recovery. (See DOWER.) All real estate conveyed to husband and wife together, unless otherwise defined by the instrument of conveyance, is deemed to be an estate known as an estate by the entirety. Its peculiarity is that while the husband is entitled to the rents, issue, and profits during coverture,

neither can convey the title without the other, and the survivor becomes entitled to the property absolutely. On the death of one of the parties to the marriage the property is disposed of as follows: if the husband dies his will may, subject to the wife's right of dower, dispose of his whole property to strangers irrespective of the wife. But there are some things his will cannot take away from her, as, for example, her leases, choses in action not reduced to possession, and her real estate. To these may be added her paraphernalia, so called, which consists of her personal apparel and jewels; but even these may be taken by her husband's creditors if there be a deficiency of assets. When the wife dies before the husband he becomes entitled to all her personal estate, of whatever description, even though she leave children of the marriage; and it must be recollected that she can at the common law, generally speaking, make no will which has any effect if the husband chooses to repudiate it. The wife's real estate passes to her heirs unless a child has been born of the marriage, in which case the husband is entitled to curtesy in the entire estate. The English courts of chancery, by application of the doctrine of uses and trusts (q.v.), mitigated to some extent the harshness of the common-law rules relating to married women. By an ante-nuptial agreement between the parties to the marriage, sometimes called a marriage settlement, not only all the property she may have had before marriage, but property to which she may afterwards be entitled, may be given to trustees to hold for her separate use. The agreement may give her a practically unlimited right over the property thus settled upon her which equity would enforce, and she may thus receive regularly the income of the trust and use of it for her own purposes. She may bind her separate estate by contract, and even dispose of it by will. Courts of equity will also in a proper case enforce agreements made between husband and wife, and in certain cases will enforce a conveyance made by the husband to the wife when made for the purpose of providing for the wife. The various rights with reference to separate property thus created and enforced by courts of equity are known as married women's separate estates.

Statutory Modification of the Common Law. The preceding statement is an outline of the rights and liabilities of the husband and wife according to the common-law rules. Half a century ago public attention was first directed toward the essential injustice of the common law to married women. The agitation which followed took fast hold upon the public conscience, and ultimately found expression both in England and the United States in a series of statutes known as married women's enabling acts. New York was the first State to adopt this reform, by an act framed in 1848, and its example was followed by other States in rapid succession. The various statutes relating to the subject have been repeatedly revised, and their scope widened by amendment, until at the present time in most jurisdictions, though the statutes differ in minor particulars, married women are on a substantial equality with their husbands with reference to both personal rights and rights of property, and each is practically independent of the other with reference to all matters outside the obligation of the status marriage or the marriage contract itself. The effect of modern statutory law will be best understood by briefly mentioning some of the more important exceptions to the foregoing statement. In probably all jurisdictions the husband is still under obligation to support his wife, and to provide her with necessaries, and the wife, by acting as his agent, may still bind the husband by contract. As the husband no longer acquires any interest in the wife's personal property or choses in action, he is not subject to the corresponding obligation to answer for her torts and contracts, they being an obligation of the wife alone, for which she may be separately sued. Either may sue or be sued independently of the other. While the husband may no longer take the wife's earnings, he is in a general sense still entitled to the wife's services, so long as she continues to give them to him; and he may sue in his own right to recover for torts causing loss of her services or expenditure by him for necessaries, and either may sue for alienation of the affections of the other. The law of domicile of the husband and wife remains unchanged. The wife still has dower in the husband's real estate, and in some of the Southern and Western States she has by statute a homestead in the husband's lands. In many States the husband may acquire curtesy in the wife's real estate, but in some, like New York, the wife may defeat his right by conveyance or will. In some States, as New Jersey, the wife cannot convey her real estate as freely as the husband may, but must be examined apart from her husband by a notary, commissioner, or judge before making the conveyance, who must ascertain whether the conveyance is freely made without coercion by the husband. Estates by the entirety are now generally obsolete, the husband and wife taking as co-tenants, or tenants in common. In nearly all jurisdictions statutes of distribution (q.v.) have been enacted, by which either party to the marriage may acquire a part of the personal property of the other in case of his or her death without having disposed of the personal property by will. In other particulars these statutes follow closely the analogy of the law of inheritance. Provision has also been made by statute in most jurisdictions for directly compelling the husband to support the wife by means of a quasi-criminal proceeding brought at her instance. The same result may be obtained by the various statutory forms of judicial separation (see Divorce), by which the husband may be compelled to pay the wife certain sums of money, or alimony (q.v.).

Scotland. The law of husband and wife in Scotland as regards their personal rights and disabilities, and the property during the marriage, does not substantially differ from the law of England, but the following points may be noticed: As regards their persons and personal rights and crimes the law is the same. It is often said that in Scotland the movable property of both husband and wife becomes a kind of joint-stock property, called *goods in communion;* but this phrase has no meaning except with reference to the principle of the division of the property after the death of one of the parties and the dissolution of the marriage. The husband is, as in England, entire master, except that he cannot on his death-bed bequeath more than a share of the property away from the wife. The wife's movable property becomes the husband's, and her heritable property remains subject to the husband's life-rent. When she disposes of her heritable property she must ratify the deed by going before a magistrate, and acknowledging that she acts of her own free will. When the husband deserts her she may, as in England, obtain a judge's order to protect her earnings and moneys, and she has a preferable right to a reasonable provision out of any property to which she may succeed (Conjugal Rights Amendment Acts, 1861 and 1874). By the Married Women's Property (Scotland) Act, 1877, the produce of a wife's industry or skill is excluded from the rights of her husband, and his liability for her antenuptial debts is restricted to the amount she brought into the marriage. A wife has, in Scotland, the power to bind her husband for necessaries; but the husband can, by a process of inhibition, give notice to tradesmen not to supply her at his expense, and this notice will be binding on all the King's subjects.

Civil Law. In the early period of the Roman law the power of the husband over his wife and her property was absolute, as the *patria potestas*. Whatever property the wife acquired, both before and after marriage, became the property of the husband; but in case the wife survived the husband she was entitled to share her husband's property equally with the children. At a later period, but before the time of Justinian, owing possibly to the lack of any formal marriage, we find a fully developed system of law relating to married women which, unlike the common law, was based upon the theory that husband and wife were in law distinct persons having independent rights and liabilities. The wife remained responsible for her own debts. She could sue and be sued independently of her husband, and her husband could not subject her property to any disability. While there were some restrictions upon the power of women to contract, there was no distinction in this respect between married women and unmarried women. The husband, as at common law, was bound to support the wife; but as compensation for this liability his wife or her family was required at the time of the marriage to provide the husband with the *dos* or dowry. The increase from the *dos* was the husband's property. He could also dispose of the *dos* so far as it was personal property, but not if it were real estate; and in the case of termination of the marriage by death or divorce, the *dos* was required to be returned to the wife. Corresponding to the *dos* was the *donatio ante nuptiam* or the *donatio propter nuptiam*, a gift made by the husband to the wife before the marriage. Not much is known of these, but it seems probable that the *donatio* was not required to be equal to the *dos*, but was given as a provision for the wife after her husband's death, she having lost the right to share equally in her husband's property with the children of the marriage. These rules of law might, however, be freely modified by antenuptial contracts, which were enforced much as courts of equity enforced antenuptial contracts entered into at common law.

Community Property. Occupying an intermediate ground between the common law and the civil law relating to the husband and wife is the law of community property. The notion of a community of interests by husband and wife in all property acquired during the coverture seems to have been derived from the civil law and the mediæval customary law, and is now incorporated into the Code Napoleon and most of the other European codes as fixing the rights of husband and wife in the abuse of contracts. The most important peculiarity of community property is the partnership of husband and wife in all property acquired by them during the coverture, and under some systems in property acquired before the marriage. The husband is the *curator* of the wife, who has no power to contract independently of her authority; but she retains her joint interest in the community property; and after her husband's death is entitled to one-half the community property, the other half passing to the heirs. The husband has the same right in case of the wife's death. See Community of Property.

Ganancial System. For the particular doctrine of community property belonging to the Spanish law, and adopted in New Mexico, and to some extent in Arizona, California, Nevada, Idaho, Texas, and Washington, see Ganancial System.

The criminal law relating to husband and wife remains substantially unchanged. The husband and wife are now generally competent witnesses in all civil actions with the exception of an action for divorce brought by one against the other, in which case neither is allowed in most jurisdictions to testify against the other or to acts of adultery; and in no case is either allowed to testify as to any confidential communication made to or received from the other during coverture. In case of testimony as to a transaction with a deceased person by or against whose representative an action is brought, a husband or a wife, because of his or her interest in the other spouse's property, may be an interested witness, and so be barred from testifying on that ground. (See Evidence.) The competency of husband and wife to testify in criminal proceedings remains as at common law. Consult: The *Commentaries* of Kent and Blackstone; Hammick, *Marriage Laws of England* (2d ed., London, 1887); Macqueen, *Rights and Liabilities of Husband and Wife* (3d ed., London, 1885); Schouler, *Domestic Relations;* the statutes of the various States in the United States; and the authorities referred to under Domestic Relations.

HUSBANDRY, Patrons of. See Grange.

HUSBANDS, hŭz′bandz, Herman (?-1795). An American revolutionist. He was born in Pennsylvania, but settled in North Carolina, and was a member of the Legislature of that Colony. In 1768 he became one of the leaders of the 'Regulators' (q.v.), an organization formed to redress grievances. After several times coming into conflict with Governor Tryon, at last, in 1771, his force of 2000 Regulators was defeated, and Husbands fled from the Colony, settling near Pittsburg. He was a member of the Pennsylvania Legislature in 1778, and at the time of the 'Whisky Insurrection' (q.v.) of 1794 was a member of the Committee of Safety with Albert Gallatin and others.

HUSCHKE, hŏŏsh′ke, Georg Phillip Eduard (1801-86). A Prussian jurist, born at Münden, and educated at the universities of Göttingen and Berlin. At Göttingen he was made instructor in Roman law (1821). Afterwards he was professor of law at Rostock (1824) and at Breslau (1827).

He took a prominent part in ecclesiastical politics, and was so strong a partisan of the Lutheran communion that his opponents brought criminal suit against him for inciting an insurrection, but unsuccessfully (1835). Later he held high ecclesiastical offices in the gift of the State, and was made Privy Councilor. As a jurist he combined the historical and philological methods. His more important works are: *Studien des römischen Rechts* (1830); *Die Verfassung des Königs Servius Tullius* (1838); *Ueber den Census und die Steuerverfassung der frühern römischen Kaiserzeit* (1847); *Gaius. Beiträge zur Kritik und zum Verständnis seiner Institutionen* (1855); *Jurisprudentiæ Antejustinianæ quæ Supersunt* (5th ed. 1886); and the valuable works on the Italic dialects: *Die oskischen und sabellischen Sprachdenkmäler* (1856); *Die Iguvischen Tafeln nebst den kleinern umbrischen Inschriften* (1859); *Zu den altitalienischen Dialekten* (1872); and *Die neue oskische Bleitafel* (1880).

HUSEMANN, hōō'ze-mån, Theodor (1833-1902). A German pharmacologist, born in Detwold and educated at Göttingen, Würzburg, Berlin, and Prague. He practiced medicine for five years, and in 1860 went to Göttingen, where he became docent (1865) and professor (1873) of pharmacology and toxicology. He wrote: *Handbuch der Toxikologie* (1862-67) and *Die Pflanzenstoffe in chemischer, physiologischer, pharmakologischer und toxikologischer Hinsicht* (1871), both with his cousin August (1833-77), who was professor at Chur; contributed to Maschka's *Handbuch der gerichtlichen Medizin* (1882) and to the Penzold Stintzing *Handbuch der speciellen Therapie* (1895); and wrote a *Handbuch der gesamten Arzneimittellehre* (3d ed. 1872) and a study on the pharmacopœias of the sixteenth century, *Die Kölnischen Pharmakopöen und ihre Verfasser* (1899).

HUSH, hųsh. See Husi.

HUSI, hōō'sē. *Rum. pron.* hōōsh, or **HUSH.** The capital of the Rumanian District of Falciu, Moldavia, situated a short distance west of the Pruth, and 38 miles south-southeast of Jassy (Map: Balkan Peninsula, G 1). It has a fifteenth-century cathedral and a theological seminary. Population, in 1889, 12,660; in 1899, 15,484.

HUS'KISSON, William (1770-1830). An English statesman. He was born in Worcestershire, and in 1783 sent to Paris to study medicine. He took part in the storming of the Bastille, and as a member of the Club of 1789 delivered before his associates a speech on the currency. After his return to England in 1792 he received a subordinate appointment under the Tory Government, and formed an intimate acquaintance with Pitt and Canning. As Under-Secretary of War (1795-1801), he did most of the work of that office. In 1796 he entered Parliament, and, with the exception of two years, remained a member for various constituencies to his death. He held several offices under Pitt, with whom he retired in 1801. In 1804 he was appointed Secretary of the Treasury in the new Pitt Cabinet, and on Pitt's death in 1806 he lost his office, but was restored to it by Mr. Perceval in 1807. In 1814 he was made Chief Commissioner of the Woods and Forests; in 1823 president of the Board of Trade, and in 1827 Secretary of State for the Colonies. Through his exertions the old restrictions on the trade of the Colonies with foreign countries were removed. He also obtained the removal or reduction of many import duties, considerable relaxation of the navigation laws, and is in fact mentioned as the great pioneer of free trade. His death, September 15, 1830, was caused by injuries received that day at the opening of the Liverpool and Manchester Railway. Consult: *Speeches*, with biographical memoir (3 vols., London, 1831); from the comprehensive views which they exhibit, as well as from their full and accurate details, these speeches are valuable to students of political economy; Wright, *Life of Huskisson* (privately printed, 1831); Hansard, *Parliamentary Debates;* Greville, *Memoirs: A Journal of the Reigns of George IV. and William IV.* (London and New York, 1874-75).

HUSS, Henry Holden (1862—). An American composer, born in Newark, N. J. He studied first with his father, George J. Huss, and in 1882 entered the Munich Conservatory, Germany, taking up the study of counterpoint, composition, and instrumentation, and the organ under Rheinberger. During his stay in Germany he studied the pianoforte under Giehrl, and conducting under Abel. In 1885 he became a resident of New York, and subsequently became well known throughout the country as a composer, pianist, and teacher. His compositions, many of which have a European reputation, include a scena for soprano and orchestra, *Cleopatra's Death;* bagatelles, anthems, intermezzi, songs, part songs, and very charming chamber music.

HUSS, John (c.1370-1415). A Bohemian religious reformer. He was born at Husinetz (or Husinec), Bohemia, northwest of Budweis. His baptismal name was Jan; from his birthplace he was called Johannes de Husseynecz, or, in English, John Huss. The day and year of his birth are unknown. His parents were Czech peasants. He studied at the University of Prague, where he soon made a reputation for scholarship, became M. A. (1396), university lecturer (1398), dean of the philosophical faculty (1401), and was rector in 1402 and 1403. In philosophy he was a realist. He became a priest in 1401. Owing to the marriage in 1382 of Anna, sister of King Wenceslas, to King Richard II. of England, there was much intercourse between Bohemia and England. So the writings of the great English theologian, Wiclif (died 1384), came into Bohemia. Huss read them eagerly, and availed himself of permission to lecture upon them in the university. He went further, and translated them into Bohemian, and the world has given Huss credit for writings which were merely translations from Wiclif. He also defended Wiclif's opinions, not only in the lecture-room, but from the pulpit. As he was a very popular preacher in the Bethlehem Chapel in Prague, and confessor to the Queen and a scholar of high repute, this stand attracted wide attention.

Wiclif had, however, not escaped the charge of heresy, and so in 1403 Huss was forbidden by the university authorities to discuss forty-five sentences or theses which he had derived mostly from Wiclif; and in 1409, when the Pope, Alexander V., had issued his bull against the teachings of Wiclif and the Archbishop of Prague had burned Wiclif's writings, Huss felt the effect of the opposition he had stirred up on the part of the hierarchy, the priests, and the monks by denouncing, in imitation of Wiclif, the corruption of the Church. In 1410 he and his followers were put under the ban. Undeterred, he kept on preaching as before. In 1411 Pope John XXIII. proclaimed a crusade against King Ladislas of Naples, and promised indulgences to the volunteers. Huss the next year gave out a university debate upon the question of indulgences, which only widened the breach between himself and the university authorities and the clergy. In 1412 a Papal interdict was issued against him. In reply he wrote his book *On the Church*, again drawing heavily from Wiclif, and appealed from the Pope to a general council and to Christ; and then, feeling no longer safe in Prague, he withdrew to the castles of certain friendly noblemen. In 1414, obedient to a summons, but under the protection of King Wenceslas, and with a safe conduct to go to Constance, given by the Emperor Sigismund, he went to the general council which had been convened in Constance.

His journey thither was a triumph, and he entered the city (November 3d) in great state. At first he was a free man, but on November 28th he was apprehended and charged with having made an attempt to leave the city, and cast into prison, in spite of the indignant protests of the Bohemian and Polish nobles. He may have fancied that he would have opportunity to defend his views in open debate, but he quickly learned that the council intended to try him as a heretic. He was, however, long kept in suspense, for it was not till June 5, 1415, that he was first formally accused. On June 8th thirty-nine charges were exhibited against him, some of which he acknowledged as fairly based upon his teachings, while others he declared to be misrepresentations. Being required to recant his alleged errors, he refused to do so until they should be proved to be errors. On June 18th the articles of his condemnation were prepared; on June 24th his books were burned; on July 1 his attempts to come to an understanding with his prosecutors failed, and on Saturday, July 6th, he was condemned to be burned at the stake for heresy. The same day the sentence was executed, and the martyr's ashes were thrown into the Rhine. The Emperor, probably influenced by the fact that condemned heretics had no claim to protection, did not interfere, as he might have done. The death of Huss caused sorrow and indignation throughout Bohemia, and led to the so-called Hussite War. See HUSSITES.

A critical edition of Huss's writings, distinguishing between his own works and his translations from Wiclif, is lacking. The best we have is F. Palacky's *Documenta Magistri Joannis Hus* (Prague, 1869). The works of Huss in Bohemian were published by K. J. Erben (Prague, 1865-68). E. de Bonnechosa published a French translation of his letters (Paris, 1846), from which an English translation was made (London, 1846); F. B. Mikowec prepared one in German (Leipzig, 1869). Nowotny began a German translation of his sermons (Görlitz, 1855). For his biography, consult: Gillett (Boston, 1863-64), and Wratislaw (London, 1882); for his relations to Wiclif, Loserth, *Wiclif and Huss*, translation (London, 1884).

HUSSARS, hŭz-zärz′. Light cavalry. Originally a distinct type of Hungarian mounted troops, receiving their name, it is said, from the circumstance of their origin, Matthias Corvinus having in 1458 raised a body of cavalry to operate against the Turks by taking one man out of every twenty inhabitants; hence the use of the word husz-ár, in Hungarian, *the twentieth*. The demand for cavalry possessing greater mobility than the dragoons, as yet the only type, led to the formation of light-cavalry regiments on the hussar model. Nearly two-thirds of the entire cavalry strength of Great Britain consists of hussar and lancer regiments, the general proportion throughout Europe being almost as great. The original Hungarian hussars had several peculiarities of dress and equipment, the most conspicuous of the former being a loose jacket suspended in part from the shoulders, a feature still preserved in several countries. See CAVALRY.

HUSSEIN AVNI PASHA, hṳ-sīn′ äv′nė pȧ-shä′ (1819-76). A Turkish general and statesman, born at Dost-Koj, near Isparta, in Western Asia Minor, and educated after his sixteenth year in Constantinople. In 1853 he entered the General Staff under Omar Pasha, and with him directed the fortification of the Balkan passes. He commanded a division in the war with Montenegro (1859-60), became General of the Guard (1864), and in 1867-69 put down the rising in Crete. As a reward for this service he was made Minister of War, from which post he was retired in 1871, after the death of Ali Pasha, his protector. In 1872, on the accession of Midhat Pasha to the Grand-Viziership, he returned to Constantinople from his exile at Isparta, became Grand Vizier in 1874, and Governor of Smyrna in 1875. In the same year he was again Minister of War for six weeks, and in May, 1876, was a leader in the plot which deposed Abdul Aziz and put Amurath V. on the throne. Less than a month later he was assassinated by an officer, Hassan Bey, at a Ministerial meeting.

HUSSITES. The followers of John Huss (q.v.). Honoring him as a martyr, about 450 Bohemian nobles formed a league, protesting against the action of the Council of Constance which had condemned Huss to be burned, and bidding defiance to decrees of bishops and the Pope. The symbol of their confederacy was the cup, the use of which in the Lord's Supper they extended to the laity, as had already been done with the approbation of Huss. King Wenceslas of Bohemia was constrained to grant them the use of many churches. After his death (August, 1419) the majority refused to recognize as King his brother, the Emperor Sigismund (q.v.), who had broken his safe-conduct given to Huss. The so-called Hussite wars followed. For eight years (1420-27) the Hussites, led by their generals Ziska (q.v.) and Procopius (q.v.), were victorious against the forces sent against them by the Emperor and the Pope, and in 1429 and 1430 they carried terror into the countries of Germany bordering on Bohemia. Convents and churches were reduced to ashes, and priests and monks were slain. From the beginning the Hussites had included two parties—the more conservative, called Calixtines (q.v.), or Utraquists, more in sympathy with the Church, and hoping for an ultimate reconciliation, and the radical, called Taborites (q.v.), who went much further in rejecting doctrines and practices of the Church. A third faction, intermediate between the two, called Orphans, also developed. In 1431 the Council of Basel (q.v.) undertook to conciliate the Hussites, and succeeded in coming to an agreement with the Calixtines by the 'Compactata of Prague' in 1433, after which the latter acknowledged Sigismund as King and made peace with the Church. The Taborites and Orphans were completely defeated in a battle near Böhmischbrod, May 30, 1434, and soon disappeared as a political power, but continued to exist as the Bohemian Brethren (q.v.).

HUSTINGS (AS. *hūsting*, from Icel. *hūsþing*, council-place, from *hūs*, AS., OHG. *hūs*, Ger. *Haus*, house + *þing*, thing, assembly, OHG. *ding*, Ger. *Ding*, thing; connected with Goth. *þeihs*, Lat. *tempus*, time). An English term applied to the place or platform where, before 1872, members of Parliament were nominated for election, or from which a candidate addressed his constituents. The term is still applied to any electioneering platform. A court of hustings formerly existed in many English cities for the trial of suits brought for the recovery of land situated within the city limits. Such a court still survives in London; but its authority, which at one time extended to all actions between citizens, has now practically disappeared. The hustings court existed in the towns of Virginia founded during the eighteenth century. Thus the charter of Norfolk Borough, incorporated in 1736, established a hustings court to be held once a month, with jurisdiction over actions of ejectment, trespass, and writs of dower, as well as all other actions, personal and mixed, involving not more than £20. A hustings court is still one of the municipal tribunals of Richmond. It is held by a judge elected in the same manner as the circuit judges, and has original and exclusive jurisdiction of most criminal offenses committed within the city limits.

HUTCH'ESON, FRANCIS (1694-1746). A moralist of the eighteenth century, born August 8, 1694, in County Down, Ireland. His father was a Presbyterian minister. He studied for the Church at the University of Glasgow, but after a short term of preaching he was induced, in 1719, to open a private academy in the city of Dublin, which proved highly successful. In 1725 he published his *Inquiry into the Original of Our Ideas of Beauty and Virtue*, etc., which was the means of introducing him to the notice of many influential personages, such as Archbishops King and Boulter, and Lord Granville, then Lord Lieutenant of Ireland. This work was followed, in 1728, by his *Essay on the Nature and Conduct of the Passions and Affections*, and in the year after he was appointed professor of moral philosophy in the University of Glasgow. Here he died, in 1746. His largest and most important work, *A System of Moral Philosophy*, was published at Glasgow in 1755 by his son, Francis Hutcheson. From the period of Hutcheson's lectures, according to Dugald Stewart, may be dated the metaphysical philosophy of Scotland. But it is as a moral philosopher, rather than as a metaphysician, that Hutcheson is noteworthy. His system is, to a large extent, that of Shaftesbury, but it is more complete, coherent, and clearly illustrated. Hutcheson emphasized the importance of 'calm benevolence,' and was a strong opponent of the doctrine that it has a selfish origin. Equally important with benevolence in his system is the moral sense, "which does not impel toward good actions, but merely judges the moral quality of actions and gives its approval to benevolence;" the latter is the mainspring of good conduct. All action prompted by benevolence is formally good; but to be naturally good it must be an action which "procures the greatest happiness for the greatest numbers." In this respect he was a forerunner of the English Utilitarians. Consult: Fowler, *Shaftesbury and Hutcheson* (London, 1882); Albee, *History of English Utilitarianism* (London, 1902); Martineau, *Types of Ethical Theory* (Oxford, 1886); Scott, *Francis Hutcheson* (Cambridge, 1900).

HUTCHINS, THOMAS (1730-89). An American geographer. He was born in New Jersey; entered the British Army at an early age, and participated in the French and Indian War. Being in London in 1779, he was imprisoned on suspicion of favoring American independence; but escaped by way of France, went to Charleston, S. C., entered the Continental Army, and was appointed 'geographer-general' by General Greene. He was the author of several geographical works, including a *Topographical Description of Virginia, Pennsylvania, Maryland, and North Carolina* (1778), and *History, Narrative and Topographical Description of Louisiana and West Florida* (1784).

HUTCH'INSON. A city and the county-seat of Reno County, Kan., 235 miles southwest of Kansas City, Mo.; on the Arkansas River, and on the Atchison, Topeka and Santa Fe, the Missouri Pacific, and the Chicago, Rock Island and Pacific railroads (Map: Kansas, E 3). It has a fine court-house, Riverside and Hutchinson parks, a public library, and the State Industrial Reformatory, the building covering fifteen acres of the entire 640 included in the grounds. The city is the centre of an agricultural and stock-raising district, and has an important wholesale trade, and extensive manufactures of salt, large deposits of rock salt being found here. Settled in 1872, Hutchinson was incorporated two years later. Its government is administered under a charter of 1872 which provides for a mayor, elected biennially, and a unicameral council. Population, in 1890, 8682; in 1900, 9379.

HUTCHINSON, ANNE (c. 1590-1643). A religious enthusiast, of American celebrity, born in Lincolnshire, England, 1590 or 1591. She was a daughter of Rev. Francis Marbury, married William Hutchinson, 1612, and emigrated to Boston, Mass., in 1634. Living in a community prone to religious excitement, she claimed to be a medium of divine revelation, and held meetings for women, in which she set forth the doctrine that those who were in the covenant of grace were not under the covenant of works, which was considered as Antinomian by the State clergy, and likely to have sad practical consequences. Great controversies arose, and a synod was called, in which her teachings were condemned, and she was banished from the Colony. She and her friends now obtained from the chief of the Narraganset Indians liberty to reside in Rhode Island, where they set up a community on the highly commendable principle that no one was to be 'accounted a delinquent for doctrine' (1638), and founded the town of Portsmouth. After the death of her husband (who shared her opinions), in 1642, she removed to the west of

Stamford, Conn., which was then Dutch territory, and there in September, 1643, she and her whole family of fifteen persons were taken prisoners by the Indians, and all but one daughter murdered. Consult: her life in Sparks's *Library of American Biography*, vol. xvi.; Adams, *Three Episodes in Massachusetts History* (Boston, 1893).

HUTCHINSON, John (1615-64). An English regicide, born in Nottingham, and educated at Cambridge. After a short study of the law at Lincoln's Inn, he identified himself with the Parliamentary side in the struggle against the King, became a member of the committee for Nottinghamshire, and throughout 1644 and 1645 acted as Governor of both Nottingham and Nottingham Castle, successfully holding them against repeated Royalist attacks, attempted bribery, and internal dissensions. In 1646 he succeeded his father, Sir Thomas Hutchinson, as a member of the Long Parliament, and two years afterwards he sat as one of the King's judges, and signed the royal death-warrant. He served under Cromwell in the Council of State until 1653, when he retired from politics, and refused further office under the Protector. He seems to have worked for a restoration of the Long Parliament, and during its short session, from May to October, 1659, he returned to his seat. He was a member from Nottingham to the Convention Parliament in 1660, but was immediately expelled as a regicide, though his life was spared through the intercession of relatives. In 1663 he was arrested as an accessory to the Yorkshire Plot, and, despite meagreness of evidence against him, was imprisoned in the Tower. In May, 1664, he was removed to Sandown Castle in Kent, where he died from fever in the following September. His wife Lucy (1620-c.1680), was very influential in saving his life when the Restoration took place, and after his death wrote a *Life of Colonel Hutchinson* (first published in 1806).

HUTCHINSON, John (1674-1737). An English theological writer. He was born at Spennithorne, near Middleham, in Yorkshire. For some time he was steward of the household of the Duke of Somerset, and left his service to devote himself to religious studies, the Duke procuring for him a sinecure appointment from the Government. In 1724 he published the first part of a work called *Moses' Principia*, in which he defended what he regarded as the Mosaic cosmogony, and assailed Newton's theory of gravitation. He continued to publish a succession of works till his death, in London, August 28, 1737. The leading principle of his religious system is that the Holy Scriptures contain the elements not only of true religion, but of all rational philosophy, which, however, was to be derived only from the original unpointed Hebrew; and for that purpose, it was subjected to strange critical or rather fanciful processes. His works at one time exercised a considerable influence, and his followers, called 'Hutchinsonians,' included some persons of considerable learning and celebrity. His works appeared in 12 volumes (London, 1748), with life by Spearman in supplement (ib., 1765).

HUTCHINSON, Thomas (1711-80). An American loyalist, the last royal Governor of the Province of Massachusetts Bay. He was born in Boston, where his father, the great-grandson of Anne Hutchinson (q.v.), was a wealthy merchant and ship-owner. He graduated at Harvard in 1727, entered his father's counting-room, early showed remarkable aptitude for business, and by the time he was twenty-four had accumulated considerable property in trading ventures on his own account. The social prominence of his family, as well as his own position in the business world, made him, while still a young man, a person of considerable importance in the community. In 1737 he was elected a member of the Boston Board of Selectmen. Later in the same year he was chosen a representative to the General Court of the Colony, and at once took a strong stand in opposition to the views of the majority with regard to a proper currency. His proposal to borrow silver in England to redeem the outstanding bills of credit, and his opposition to the revival of the Land Bank, made him unpopular with the people, and impelled his constituents in town meeting to draw up 'instructions,' disregard of which led to his retirement in 1740. In that year he went to England as a commissioner to represent Massachusetts in a boundary dispute with New Hampshire. In 1742 he was reëlected to the General Court, and was thereafter chosen annually until 1749, serving as Speaker from 1746 to 1749. He continued his advocacy of a sound currency, and when the British Parliament reimbursed Massachusetts in 1749 for the expenses incurred in the Louisburg expedition, he proposed the abolition of the bills of credit, and the utilization of the Parliamentary repayment as the basis for a new colonial currency. The proposal was finally adopted by the Assembly, and its good effect on the trade of the Colony at once established Hutchinson's reputation as a financier. On leaving the General Court he was appointed at once to the Governor's Council; in 1750 he was chairman of a commission to arrange a treaty with the Indians in the District of Maine; and he served on boundary commissions to settle disputes with Connecticut and Rhode Island. In 1752 he was appointed judge of probate, and a justice of the Common Pleas. In 1754 as a delegate from Massachusetts to the Albany Convention (q.v.) he took a leading part in the discussions, and favored Franklin's plan for colonial union, although doubting its practicability. In 1758 he was appointed Lieutenant-Governor, and in 1760 Chief Justice of the Province. In the following year, by issuing writs of assistance (q.v.), he brought upon himself a storm of protest and criticism. His distrust of popular government as exemplified in the New England town meeting increased. Although he opposed the principle of the Stamp Act (q.v.), considered it impolitic, and later advised its repeal, he accepted its legality, and as a result of his stand. his city house was sacked by a mob in August, 1765, and his valuable collection of books and manuscripts destroyed. In 1769, upon the resignation of Governor Bernard, he became Acting Governor, serving in that capacity at the time of the 'Boston Massacre' (q.v.), March 5, 1770, when popular clamor compelled him to order the removal of the troops from the city. In March, 1771, he received his commission as Governor. His administration, controlled completely by the British Ministry, increased the friction with the patriots. The publication, in 1773, of some letters on colonial affairs written by Hutchinson, and obtained by Franklin in

England, still further aroused public indignation, and led the Ministry to see the necessity for stronger measures. The temporary suspension of the civil Government followed, and General Gage was appointed military Governor in April, 1774. Driven from the country by threats in the following May, and broken in health and spirit, Hutchinson spent the remainder of his life an exile in England. There, still nominally Governor, he was consulted by Lord North in regard to American affairs, but his advice that a moderate policy be adopted, and his opposition to the Boston Port Bill, and the suspension of the Massachusetts Constitution, was not heeded. His American estates were confiscated, and he was compelled to refuse a baronetcy on account of lack of means. He wrote a *History of Massachusetts Bay* (vol. i. 1764, vol. ii. 1767, and vol. iii. 1828), a work of great historical value, calm, and judicious in the main, but entirely unphilosophical and lacking in style. His *Diary and Letters* were published in 1884-86. Consult also: Hosmer, *Life of Thomas Hutchinson* (Boston, 1896); and the chapter "Thomas Hutchinson, the Last Royal Governor of Massachusetts," in Fiske, *Essays, Historical and Literary*, vol. i. (New York, 1902).

HUTCHINSON, THOMAS JOSEPH (1820-85). An English explorer, born at Stonyford, Ireland. He studied medicine and, after a trip to West Africa in 1851, was chief surgeon on the Niger Expedition (1854-55). After two years as English consul at the Bight of Biafra and Fernando Po, he became Governor of the latter place (1857), and in 1861 was transferred to the consulate at Rosario in Argentina, where a year later he took part in the Salado Expedition. In 1870 he was appointed consul at Callao, and three years later retired to his Irish property. He wrote: *Narrative of the Niger Tshadda Binuë Exploration* (1855); *Impressions of Western Africa* (1858); *Ten Years' Wandering Among the Ethiopians* (1861); *Buenos Ayres and Argentine Gleanings* (1865); *Parana and South American Recollections* (1868); *Two Years in Peru* (1874); and *Summer Rambles in Brittany* (1876).

HUTCHISON, JOHN (1832—). A Scottish sculptor, born in Edinburgh. He learned his trade there as a wood-carver, but was attending the art school at the same time, and graduated as a sculptor after studying for some time at Rome. His early work was exhibited in the Royal Scottish Academy, but his first appearance in the corresponding London Gallery was in 1862. Apart from purely imaginative work, he made statues of Robert Bruce, John Knox, Norman McLeod, Queen Victoria, and the Prince Consort, as well as of other personages less notable, while he left his mark conspicuously upon his native city in the figures representing four of Scott's characters in the monument to Sir Walter on Princes' Street.

HUTIA, ōō-tē'ȧ (Sp., from the native name). A West Indian rodent or hog-rat, of the family Octodontidæ, differing from rats in having four grinders on each side in each jaw, with flat crowns. The tail is round and slightly hairy, and is used for support in sitting erect, as by kangaroos, and for aid in climbing trees. They make much use of their fore paws as hands. They are closely allied to the coypu (q.v.), but are not aquatic, and make their home in the woods. The best-known species is the hutia-couga (*Capromys pilorides*) of Cuba, which is about 22 inches long to the root of the tail. The fur is long, coarse, and yellowish brown, with the paws and ears blackish. Another Cuban species is the hutia-carabali (*Capromys prehensilis*), the tip of whose tail is prehensile. The hutia-couga is a skillful climber, and lives in dense forests. Its food is chiefly fruits, leaves, and bark; but it also eats the flesh of small animals, particularly that of a kind of lizard. It is easily tamed, and the Cubans consider its flesh a delicacy, for which reason it is much hunted by the natives. The smaller hutia-carabali is said to live chiefly in the tops of trees.

Jamaica has a short-tailed hutia (*Capromys brachyurus*) (see Plate of CAVIES, ETC.), locally called 'coney,' which has become rare; and Ingraham's hutia (*Capromys Ingrahami*) inhabits the Bahamas. Consult Poey, *Memorias* (Havana, 1860-62).

HUTTEN, hụt'ten, PHILIP VON (c.1515-46). A German adventurer, and relative of Ulrich von Hutten (q.v.). He was one of the 600 adventurers collected from all parts of Europe who went out under George Hohermuth (better known as George of Speyer) to conquer the Province of Venezuela, which had been granted by Emperor Charles V. to the great Augsburg family of Welser (q.v.). When Hohermuth died in 1540, Hutten became Captain-General, and the next year, in company with young Bartholomäus Welser, eldest son of the head of the family, left Coro with a well-equipped force to seek the mythical El Dorado (q.v.). After wandering about for five years, the remnant of the expedition returned to Venezuela to find a new Governor in power. Juan de Caravajal had been appointed by the Audiencia of Santo Domingo to preserve order in Venezuela, but as the years went by with no news of Hutten and his followers, he began to feel secure in his position. Consequently, the return of the adventurers was anything but welcome to him. When he saw how diminished they were in number he thought to force from them an acknowledgment of his authority. In this, however, he was unsuccessful, as he also was in an attempt to seize them. In fact, this last effort was well nigh disastrous to himself, for he was wounded by Welser, and forced to pledge the Germans safe passage to the coast. Relying upon Caravajal's word of honor, the adventurers took no precautions against attack, and were easily captured by the treacherous Spaniard, who, after keeping Hutten and Welser in chains for a time, had them beheaded. Hutten seems to have been a man of higher character than most of those with whom he was associated. He left a narrative of his adventures entitled *Zeitung aus Indien* (1785).

HUTTEN, ULRICH VON (1488-1523). A scholar, poet, and reformer of the German Renaissance, one of the most celebrated of the Humanists. He was descended from an ancient and noble family, and was born at the Castle of Steckelberg in Hesse, April 21, 1488. At the age of ten he was placed in the neighboring monastery of Fulda, but, disliking this mode of life, fled in 1505 to Cologne, where he met Hoogstraten, Johannes Rhegius, and other scholars of the day. In 1506 he came to Erfurt, but soon after rejoined Rhegius at Frankfort-on-the-Oder. There he took his master's degree and published his first poem. In 1507 he followed Rhegius to Leipzig. He was stricken down with the pestilence in the following year, but recovered, and at Wittenberg in 1511 published his *Ars Versificatoria*. During these years he led the life of a wandering poet, subsisting on the bounty of those who admired his talents or feared his mordant wit. In 1512 he went to Pavia to study law. He had been there only a short time when the city was plundered by the Swiss, and Hutten was deprived of all he possessed. For a short time he served as a soldier in the Imperial army, but soon returned to Germany, where he boldly entered into a quarrel with the Duke of Württemberg, who had murdered a kinsman of Ulrich's, and brought about the Duke's punishment. In the dispute between Reuchlin (q.v.) and the Dominicans, Hutten came to the support of the former, and displayed no small learning and great power of satire. He went again to Italy in 1515, to take the degree of doctor of laws, and returned to his native country in 1517. He was crowned with the poets' laurel crown at Augsburg by the Emperor Maximilian, who conferred on him the honor of knighthood. While in Italy Hutten had become imbued with a fierce hatred for the Papacy, which he bitterly attacked in his preface to an edition of Laurentius Valla's *De Donatione Constantini*, published in 1517. In the following year he accompanied his patron, Albert, Archbishop of Mainz, to the Diet of Augsburg, where Luther had his famous conference with Cajetan. Subsequently he established a small printing press of his own, and employed himself in putting forth pamphlets written in the German language violently attacking the Pope and the Roman clergy. The Archbishop Albert denounced him at Rome, whereupon Hutten took sides with Luther, whom he had hitherto affected to despise. Persecuted by his enemies, he availed himself of the protection of Franz von Sickingen, but was forced to flee from the latter's castle after a two years' residence (1520-22). Going to Basel, he was coldly received by Erasmus, who did not approve of his extreme measures, and a breach took place between the two men which culminated in a great literary quarrel. From this time Hutten was compelled to adopt a wandering life. He died August 23, 1523, on the island of Ufnau in the Lake of Zürich. Hutten was more open in the expression of his opinions than any other man, probably, of his age. He did much to prepare the way for the Reformation and to promote it. He was a master of the Latin language, and excelled in satirical and passionate invective. His literary life is generally divided into three periods: (1) Period of Latin poems (1509-16); (2) period of letters and orations (1515-17); (3) period of dialogues and letters in Latin and German (1517-23). In all he published some forty-five different works, but his most noteworthy contribution to literature was his portion of the immortal *Epistolæ Obscurorum Virorum* (q.v.). Hutten's collected works, *Opera Omnia*, were published at Leipzig in seven volumes (1859-70) under the editorship of Böcking. Among several biographies by German authors that by Strauss (6th ed., Bonn, 1895), abridged in English by Sturge (London, 1874), is especially to be recommended. Consult also: the monographs by Reichenbach (Leipzig, 1877), and Schall (Halle, 1890); and Szamatólski, *Ulrich von Hutten's deutsche Schriften* (Strassburg, 1891). A good brief sketch in English is Jordan, "A Knight of the Order of Poets," in *The Story of the Innumerable Company* (San Francisco, 1896).

HUTTER, hụt'tĕr, Leonhard (1563-1616). A German Lutheran theologian, born at Nellingen, near Ulm. He studied at the universities of Strassburg, Leipzig, Heidelberg, and Jena, and after lecturing at Jena for several years, answered a call to Wittenberg. He was one of the most resolute and influential representatives of the Lutheran faith, and was known as Redonatus Lutherus. He attacked the Calvinist doctrines in his *Concordia Concors* (1614), which he wrote as an answer to Hospinian's *Concordia Discors* (1607).

HUTTON, Charles (1737-1823). A self-educated English mathematician, born at Newcastle-on-Tyne, of humble parentage. He received most of his education in a school at Jesmond, where, at the age of eighteen, he became master. The number of pupils having increased, he, in 1760, opened a mathematical school in Newcastle, and also taught mathematics at the Head School of the city. Among his pupils was John Scott, afterwards Lord Eldon, Chancellor of England. In 1770 he was engaged by the city of Newcastle to draw up an accurate map of the city and the suburbs. He became professor of mathematics in the Royal Military Academy at Woolwich (1773), and the following year was made a fellow of the Royal Society. He made important contributions to the *Philosophical Transactions*, and in 1778 gained the Copley medal for his papers on "Force of Exploded Gunpowder," and "Velocities of Balls." He was appointed by the Royal Society to determine the mean density and mass of the earth. His report appeared in the *Philosophical Transactions* for 1778. In 1779 he was made foreign secretary of the Royal Society, but resigned in 1783. Owing to failing health, he resigned his professorship in 1807, and was granted a pension of £500 a year. He was editor of the *Ladies' Diary* from 1774 to 1817. The most important of his works are, besides those mentioned above: *The Diarian Miscellany* (1775); *Mathematical Tables* (1785); *Mathematical and Philosophical Dictionary* (1795); *A Course of Mathematics* (1798 and subsequent editions); *Recreations in Mathematics and Natural Philosophy*, from the French of Montuela (4 vols., 1803); "On Cubic Equations and Infinite Series," in the *Philosophical Transactions* for 1780.

HUTTON, Frederick Remsen (1853—). An American mechanical engineer, born in New York City, and educated at Columbia College, and the School of Mines, where he became assistant on being graduated, and in 1891 professor of mechanical engineering. In 1883 he had been elected secretary of the American Society of Mechanical Engineers, and in 1892 became an associate editor of the *Engineering Magazine*, and in 1893 became an editor of *Johnson's Cyclopædia*. Hutton wrote reports on machine tools for the Census of 1880; and *Mechanical Engineering of Power Plants* (1897).

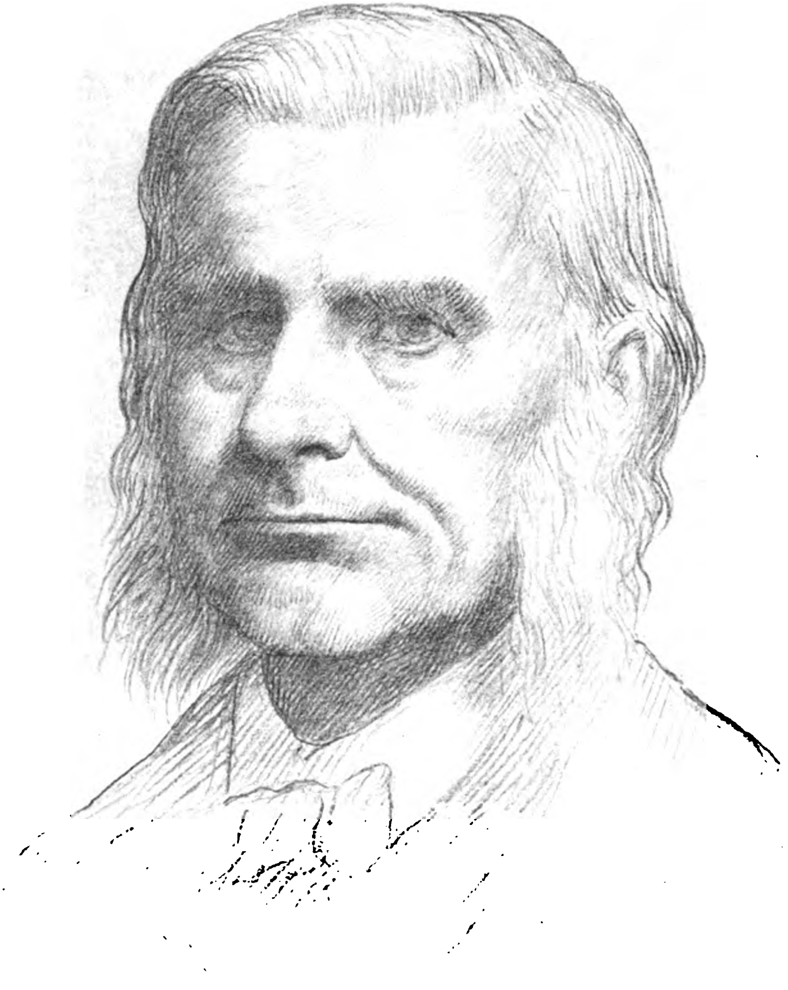
HUTTON, James (1726-97). An eminent British geologist. He was born in Edinburgh, and educated at the university in that city. After serving a year's apprenticeship in a law office, he relinquished his plan of joining the legal profession, and entered upon the study of medicine, taking courses at Edinburgh, Paris, and Leyden. In 1750 he returned to Scotland, and for several years was engaged in agricultural pursuits. Upon removing to Edinburgh in 1768 he came in contact with Ferguson, Black, and other savants, who encouraged and directed his scientific investigations. The results of a long and careful research into geological processes were formulated in a paper entitled "Theory of the Earth," which he read before the Royal Society in 1785, and afterwards amplified and published as *The Theory of the Earth, with Proofs and Illustrations* (1795). This work, although attracting little notice at the time, established a place for its author among the foremost thinkers in the realm of geological science. One of the fundamental principles of Hutton's theory was based on the internal heat of the earth, which has shown itself in past ages by the intrusion of molten rocks into the crust, and by upheaval of the superficial strata. This view was combated by the followers of Werner, but it is now generally accepted as correct. He further developed the principle that the study of geological phenomena should be based upon observation of changes going on at the present time, and thus in a way originated the doctrine of uniformitarianism (q.v.), afterwards elaborated and expounded by Lyell. The great value of Hutton's work was not fully appreciated until several years after his death, when Playfair brought out the "Illustrations of the Huttonian Theory." Hutton contributed frequently to the "Transactions of the Royal Society of Edinburgh," and also published several extended works, among the most important of which are: *Dissertations on Different Subjects in Natural Philosophy* (1792); *Investigation of the Principles of Knowledge* (1794); and *A Dissertation upon the Philosophy of Heat, Light, and Fire* (1794).

HUTTON, LAURENCE (1843-1904). An American essayist and critic, born in New York City. He was educated privately and at the age of nineteen entered commercial life, which proved uncongenial. Various visits to European cities strengthened an inborn taste for letters, and after acting from 1872 until 1874 as dramatic critic of the New York *Evening Mail*, he devoted himself entirely to literature. From 1886 till 1898 he was the literary editor of *Harper's Magazine*. He was one of the organizers of the Authors Club, and of the International Copyright League. The private collection of literary curiosities gathered by him is unique, one of the most complete in the world. In 1892 he received the degree of A.M. from Yale, and in 1897 from Princeton. His writings on dramatic subjects include: *Plays and Players* (1875); *Curiosities of the American Stage* (1887); *Memoir of Edwin Booth* (1893); and with Brander Matthews, *Actors and Actresses of Great Britain and of the United States* (1886-87). He edited the "American Actor Series" (1881-82); compiled other books on subjects connected with the American stage; and published a group of delightful literary guide-books including *Literary Landmarks of London* (1887); of *Edinburgh* (1892); of *Jerusalem* (1895); of *Venice* (1896); of *Florence* (1897); of *Rome* (1897).

HUTTON, RICHARD HOLT (1826-97). An English journalist and critic. He was the son of a Unitarian minister, and was born June 22, 1826, in Leeds, Yorkshire. The family removed to London in 1835. Hutton was educated at University College School, and subsequently at the college itself, with a view to the Unitarian ministry. After two semesters in Germany, he returned to London; and finding no adequate sphere in the ministry, he became principal of University Hall. Resigning on account of ill health, which necessitated a trip to the West Indies, he studied law. Under the influence of F. D. Maurice he entered the Church of England. In 1861 Meredith Townsend bought the *Spectator*, and called in Hutton to aid him in conducting it. As editor of this paper for twenty-five years Hutton exerted great influence. Liberal but not radical in tone, it became in his hands the organ of the very best contemporary thought. As a critic Hutton came to speak with much authority. His best work is represented by *Essays, Theological and Literary* (1871), containing under the second division essays on Goethe, Wordsworth, Shelley, Byron, Browning, George Eliot, and Clough; *Essays on Some Modern Guides of English Thought* (1887), treating of Carlyle, Newman, Matthew Arnold, George Eliot, and F. D. Maurice. He also wrote a life of Scott (1878), and edited the *Biographical Studies of W. Bagehot* (1881). Hutton died September 9, 1897, at Crossdepe. Consult Hogben, *R. H. Hutton, a Monograph* (Edinburgh, 1900).

HUX'LEY, THOMAS HENRY (1825-95). An English naturalist and comparative anatomist. He was born at Ealing, now a suburb of London, May 4, 1825. He studied in the Medical School of Charing Cross Hospital, and in 1845 was graduated as M.B. and medalist at the University of London. In 1846 he was appointed assistant surgeon on the *Rattlesnake* of the Royal Navy, commanded by Capt. Owen Stanley, which was to survey the region of the Great Barrier Reef, east and north of Australia. Imbued with a passion for natural history, Huxley devoted himself to the study of the marine animals seen and collected during the four years of this survey service. His most important research, "On the Anatomy and the Affinity of . . . the Medusæ," was published during his absence and placed its author in the front rank of biologists. He demonstrated that the body of the medusa is essentially built up of an inner and an outer membrane, which he asserted were the homologues of the two primary germinal layers in the vertebrate embryo. (See EMBRYOLOGY.) This discovery stands at the basis of modern philosophical zoölogy, and of a true conception of the affinity of animals.

In 1850, on his return to England, Huxley began a hard struggle against adversity and discouragement. Disappointed in the hope that the Admiralty would provide for the publication of his notes and drawings, he published the more important in the *Philosophical Transactions* (1851), and in the same year was elected a fellow of the Royal Society, which in 1852 gave him its medal. In 1854 he succeeded Edward Forbes as professor of natural history and paleontology at the Royal School of Mines. This was in the line of direct advancement, for his great ability as an educator and administrator, as well as in original research, brought him to many posts of honor, such as, in 1855, the Fullerian professor-



THOMAS HENRY HUXLEY
FROM THE PORTRAIT BY A. LEGROS

ship of comparative anatomy at the Royal Institution; in 1863, the Hunterian professorship at the Royal College of Surgeons; in 1868, the presidency of the Ethnological Society; in 1869, the presidency of the Geological Society; in 1870, the presidency of the British Association for the Advancement of Science, and a seat on the first school board of London; in 1871, the secretaryship of the Royal Society, of which he became president in 1883; in 1872, the lord rectorship of Aberdeen University; in 1881, the professorship of biology in the Royal College of Science (an expansion of the earlier chair in the Royal School of Mines); in 1892 Privy Councilor. He served on no fewer than ten royal commissions, of which the most important were that of Inquiry into the Sea Fisheries (1864-65), and that on Scientific Instruction, and the Advancement of Science (1870-75).

Huxley's gifts of exposition were as remarkable as his powers of research. His scientific lectures, like his papers, were models of clearness, as well as accuracy, and he was both cogent and eager in debate, and fascinating in popular address. In 1858 he delivered the 'Croonian' lecture on the "Origin of the Vertebrate Skull," in which he disposed forever of the hypothesis that the skull is, homologically, an expanded section of the vertebral column. The very next year *The Origin of Species* was published. Convinced by its arguments, Huxley threw himself heart and soul into their support, adducing much telling corroboration from his own investigations. His series of lectures to London workingmen in 1860 had this for their theme, and did much to further the acceptance of the new doctrines. They were the basis of the powerful book *Man's Place in Nature,* and were succeeded by many addresses, essays, and debates, influential in informing the public and overcoming both scientific objections and religious alarm. It may fairly be said that science as contained in the doctrines of organic evolution, and especially in the views of Darwin, is almost as much indebted to the lucid exposition and bold championship by Huxley as to the originators of the theories. Nevertheless Huxley accepted Darwin's hypothesis of natural selection with a qualification. He pointed out the lack of evidence that any group of animals has, by variation and selective breeding, given rise to another group in the least degree infertile with the first; but he believed this objection might disappear under prolonged observation and experiment. As to Lamarck's theory of use-inheritance (q.v.), he declared, in 1890, his absolute disbelief, as the evidence then stood.

Huxley came to America in 1876, and delivered in New York three lectures on Evolution, taking as his texts the series of fossil horses. During that visit he delivered the opening address at Johns Hopkins University. Huxley's contributions to science were of the widest range, and embraced every department of biology. His exposition of the relations of protoplasm as the physical basis of life is particularly masterful. He was not only a man of science, but a publicist. His services were always at command for the promotion of political, social, and moral reform—first and chiefly for the cause of national education. His devotion to labors thus entailed, added to professional toil, did much to undermine his health, which for some years toward the end of his life was very poor. He died at Eastbourne, June 29, 1895.

Professor Huxley bore an honorable part in creating the knowledge which will make the nineteenth century memorable; and a great part of it was made permanent in a series of books, of which the following is a complete list: *Oceanic Hydrozoa* (1859); *Evidence as to Man's Place in Nature* (1863); *Elementary Physiology* (1866; 4th ed. 1885); *Lay Sermons, Addresses, and Reviews* (1870; 3d ed. 1887); *Anatomy of Vertebrated Animals* (1871); *Critiques and Addresses* (1873); *Elementary Biology* (with Dr. H. N. Martin) (1875; 2d ed. 1876; 3d ed., edited by G. B. Howes and D. H. Scott, 1877); *American Addresses* (1877); *Anatomy of Invertebrated Animals* (1877); *Physiography* (1877); *Hume* (1878); *The Crayfish: An Introduction to the Study of Zoölogy* (1880); *Collected Essays* (9 vols., 1893-94). These contained some reprinted material as follows: *Method and Results; Darwiniana; Science and Education; Science and Hebrew Tradition; Science and Christian Tradition; Hume, Man's Place in Nature; Discourses, Biological and Geological; Evolution and Ethics,* and other essays. Four volumes of Huxley's *Scientific Memoirs,* edited by Sir Michael Foster and Prof. E. Ray Lankester, were published between 1898 and 1902. An authorized collection of his minor writings appeared in eight duodecimo volumes (New York, 1897-1900).

His *Elements of Biology* became the model for a large number of laboratory manuals, and his *Crayfish* is a classic of the methods of the investigator and the instructor combined. Whatever his theme, the weight and honesty of his thought and the distinction of his style make his works part and parcel of the best books of his time.

Consult: *Life and Letters of Thomas Henry Huxley,* by his son, Leonard Huxley (2 vols., London, 1900), which contain a complete list of his writings and of the honors awarded him; *Thomas Henry Huxley: A Sketch of His Life and Work,* by P. Chalmers Mitchell (London, 1900); *Thomas Henry Huxley,* by Edward Clodd (London and New York, 1902).

HUY, ụ'ē'. A strongly fortified town of Belgium, in the Province of Liège, situated amid lofty rocks on both banks of the Meuse, 18 miles by rail from Liège (Map: Belgium, D 4). Its citadel, dating from 1822, is partly excavated in the solid rock and commands the passage of the river. The Church of Notre Dame, a graceful Gothic edifice, was begun in 1311 and restored after having been partially destroyed by fire in the sixteenth century. The town contains distilleries and paper-mills, and in the vicinity are iron-works and coal-mines. Population, in 1890, 14,486; in 1900, 15,061. In one of the suburbs of Huy was formerly situated the Abbey of Neufmoustier, founded by Peter the Hermit, who was also interred within it. Huy was taken repeatedly by the Dutch and French in the many wars which swept over this region, and was last captured by Marlborough and Coehoorn in 1703.

HUYDECOPER, hoi'de-kō̆'pẽr, BALTHASAR (1695-1778). A Dutch poet and critic, born at Amsterdam. One of his first books, *Proeve van taal- en dichtkunde op Vondel's Herscheppingen van Ovidius* (1730), or annotations to Vondel's translation of Ovid's *Metamorphoses,* is an important contribution to classical study. So is his edition of the chronicle of *Melis Stoke* (1772). He was the most notable of those who attempted to purify the Dutch language, and to render it more flexible. His collected poems were published in 1788. As a dramatist he was not so successful. Among his plays are a translation of Corneille's *Œdipe*, and *Achilles* (1719), an original drama, for some time very popular. He also made a verse translation of the *Satires* and *Epistles* of Horace (1737).

HUYGENS, hī'gĕnz, *Dutch pron.* hoi'gĕns, CHRISTIAN (1629-95). A celebrated Dutch mathematician, physicist, and astronomer. He was born at The Hague, the second son of Constantijn Huygens van Zuylichem, a poet and secretary and counselor to the Princes of Orange. He studied at Leyden and Breda, devoting himself at first to law, and then pursuing the study of mathematics. At the invitation of Minister Solbert of France, he settled in Paris, being given rooms in the Royal Library and made a member of the Academy. After the revocation of the Edict of Nantes he returned to Holland, where he lived the rest of his life. His early work, *Theoremata de Quadratura Hyperbolis, Ellipsis, et Circuli, ex Dato Portionum Gravitatis Centro* (1651), is an example of the talent which lay at the foundation of all his scientific achievements. This was followed by his *De Circuli Magnitudine Inventa* (Leyden, 1654), reprinted in Rudio, *Archimedes, Huygens, Lambert, Legendre* (Leipzig, 1892), the object of each work being to expose the fallacies of Gregoire de Saint-Vincent. He also worked on the doctrine of probabilities already founded by Pascal and Fermat and published *De Ratiocinatione in Ludo Aleæ* (1656). Huygens was the first to apply the pendulum to clocks and to use the device to determine the acceleration of gravity. A complete description of Huygens's apparatus is contained in his great work, *Horologium Oscillatorium, sive de Motu Pendulorum* (1673). He also developed and gave precision to the investigations of Galileo upon accelerated motion under the action of gravity; and there is no doubt that to his studies and discoveries his great successor, Newton, in preparing his magnificent development of the principle of accelerating force, was largely indebted. Newton was a student and admirer of his works, and assigns to him, along with Sir Christopher Wren and Wallis, the distinguished epithet of *hujus ætatis geometrarum facile principes.*

Huygens was the first to construct powerful telescopes, and in 1655 discovered the ring of Saturn and the fourth satellite of that planet. In 1659 he published an account of these discoveries in a work entitled *Systema Saturnium.* In the end of this work is described an invention of great importance in astronomy; namely, the micrometer (q.v.), by which small angles between objects viewed by a telescope are accurately measured.

In 1660 Huygens visited England, where he was admitted a member of the Royal Society. Huygens was the originator of the wave theory of light; and this theory, now accepted, was first stated by him in 1678, in his *Traité de la lumière* (first printed in 1690; modern German translation in *Ostwald's Klassiker No. 20*, Leipzig). In this theory light is conceived to be a form of motion in the medium through which it passes. (See LIGHT.) Later (1690) he was able to explain both reflection and refraction by wave-motion in the ether, and was also able to account for double refraction. To Huygens is due the discovery of polarization, a phenomenon which could not then be explained by the undulatory theory, and led Newton to adopt the emission theory. Huygens was in error, however, in believing that the vibrations were longitudinal rather than transverse. The undulatory theory, however, did not gain general acceptance until the nineteenth century, when the experiments of Young and Fresnel placed it on a firm basis.

A new edition of Huygens's collected works has been published by the Holland Academy of Sciences in six volumes (The Hague, 1888-95). For his biography, consult Bosscha. *Christian Huygens*, German translation by Engelmann (Leipzig, 1895).

HUYGENS, CONSTANTIJN (1596-1687). One of the greatest writers in Dutch literary history. He was born at The Hague. His father was secretary to the State Council, and from childhood he was trained to diplomacy and in every polite art. Intellect in him was joined to beauty and strength. He studied at Leyden, London, and Oxford, and became a warm friend of Dr. Donne. Returning to Holland in 1620, he was sent on a diplomatic mission to Venice and twice to London (1621-23). Meantime he had published *Batava Tempe*, a versified series of local legends and scenes, and a volume of satires, *Costelick Mal.* Then followed (1625) a large volume of miscellaneous poems, *Otia, Ledighe uren.* That year he was made private secretary to the Stadtholder, and in 1630 member of the Privy Council, wherein he long used political power with vigor and wisdom. In 1634 he translated Donne's poems, and on the death of his wife (1637) composed *Dagwerck*, a sort of didactic elegy suggesting the manner of Tennyson's *In Memoriam. Hofwijck*, a poem on moral life, appeared in 1654. A collected edition of his poems appeared as *Korenbloemen* in 1658; his solitary drama, *Trijntje Cornelis*, in 1659. Although Huygens was not the greatest of Dutch poets or of Dutch statesmen, he was, in the combination of his qualities, one of the most dignified and brilliant talents of the days of Holland's greatness. As a poet he had more feeling for form and mastery of language, more ease and facility, than any other in his language. Consult Jorissen, *Constantijn Huygens* (Amsterdam, 1871).

HUYGENS'S PRINCIPLE. See LIGHT.

HUYSMANS, ụ'ĕs'mäɴ', JORIS-KARL (1848—). A French novelist, born in Paris, of a Flemish family, some members of which had achieved distinction as painters at Antwerp in the seventeenth century. He began literary life as a disciple of the crassest realism, as one may see by the fact of his contribution to *Les Soirées de Médan.* His novels present every stage of an evolution from sensual materialism, through spiritualism and Satanism to Christian mysticism, in which there is indeed a curious strain of the sensual and material still. *Marthe* (1877) is a study of sordid prostitution, coinciding significantly in date with Goncourt's *Fille Eliza* and Zola's *L'assommoir.* In *Les sœurs Vatard* (1879) Huysmans shows himself still a dilettante of moral anguish, sordid wretchedness, and contemptible vice. *En ménage* (1881) is a cynical commendation of marriage and *A vau-l'eau*

(1894) is a *tour de force* in nauseating description. Then in *A rebours* (1884) Huysmans turns as it were in a fierce desperation from materialism to a frenzied spiritualism. "All that transfigures or transforms reality enchants him," he makes his hero say. After this there are some barren years save for the insignificant *En rade* (1887) and *Un dilemme* (1887). Then *Là-bas* (1891) carries the psychic evolution a step further in a morbid treatment of astrology and Satanism. This recrudescence of the occult and reassertion of the extra-natural suggests a fascinated contemplation of religious mysticism, and in *En route* (1896) we find Huysmans indeed 'on the road' toward such Christianity as may be consistent with pessimism. From this point the progress is steady and the course plain. *La cathédrale* (1897) carries the reader to the door of a Benedictine retreat, and *L'oblate* (1898) ushers him within. All this latter work is full of "fingering spiritual muscles to see if they are growing;" it is thoroughly morbid, but thoroughly characteristic, too, of a French generation weary of material progress and of all problems save those that defy solution. Yet in spite of glaring errors of taste, in spite of a recondite vocabulary and of a studied absence of structural unity, these novels are perhaps the frankest and subtlest analyses of the progress of a pilgrim soul since Bunyan's Christian allegory. And they are essentially autobiographic; for Huysmans, like his hero, retreated for some time to a Trappist monastery, and became an unprofessed member of the Benedictine community at Solesmes, "too much a man of letters to be a monk, too much a monk to stay among men of letters," as is said of Durtal in the conclusion of *En route*, which is to English readers the most attractive of all his works and "one of the most characteristic novels of our quarter century." It is well translated by Kegan Paul.

HUYSUM, hoi'sum, JAN VAN (1682-1749). A celebrated Dutch painter of flowers and fruits. He was born at Amsterdam, April 15, 1682, and acquired the rudiments of his art from his father, JUSTUS (1659-1716), a landscape painter of considerable talent. Jan at first devoted himself to landscapes, in the classic style, smooth and lifeless, and only later in life began to paint fruits and flowers, studying especially the works of De Heem and Abraham Mignon (q.v.). His work differed from that of his predecessors in that he preferred to paint upon a light background. He surpassed in mellowness, purity, and delicacy of coloring, and in the exquisite disposition of his lights and shadows. He was fond of introducing birds' nests with eggs, dewdrops, insects, butterflies, and like motifs, rendered with such realism as almost to produce an illusion. The tissue of his flowers and the soft down of his fruit are incomparable in delicacy. His works were very popular and commanded the highest prices. He died at Amsterdam, February 7, 1749. Huysum's masterpieces are in the chief German and Dutch galleries, especially those of Berlin and Amsterdam; the Louvre is the richest of all, having ten pieces, and there are excellent examples in the English private collections.

HUZVARESCH, hōōsh-vä'rĕsh. See PAHLAVI LANGUAGE AND LITERATURE.

HWANG-HAI, hwäng'hī'. See YELLOW SEA.

HWANG-HO, hwäng'hō'. See HOANG-HO.

HWANG-TI, hwäng'tē' (Chin., Yellow Emperor, or Ruler). The third of the *Wu Ti*, or 'Five Sovereigns,' who are reputed to have governed China in its legendary period, prior to B.C. 2356. Like Fuh-hi (q.v.) and many more of the great leaders of Chinese primitive times, his birth was miraculous, and many wonderful things are attributed to him. The year B.C. 2697 is given as the first of his reign, and as he ruled under the influence of the element *earth*, he became known as the 'Yellow Emperor,' a circumstance which, if he ever lived, might point to the region now known as Shen-si (q.v.) as the location of his realm. There the earth is yellow, the atmosphere is tinged with yellow, and trees, houses, etc., are covered with the yellow dust from the mantle of loess (q.v.) which covers half the province. Yellow is still the Imperial color. He is said by the Chinese to have regulated the calendar, and to have introduced in the sixty-first year of his reign the sexagenary cycle by which successive days have ever since been designated, the application of the cycle of years dating only from the Han dynasty (which began in B.C. 206). He is also credited with having introduced a decimal system, the arts of wood, pottery, and metals, boats and wheeled vehicles, and many other beneficent things. To Hwang-ti's wife is due the credit of having been the first to instruct the people in the rearing of silkworms. That Hwang-ti was a virtuous ruler and his reign a prosperous one are vouched for by the statement that both the Fū-hwang and the K'ī-lin appeared in his court. He died at the age of 111, and was succeeded by Shao-hao, B.C. 2597. See the *Chinese Repository*, vol. xi.; Mayer, *Chinese Reader's Manual* (Shanghai, 1874); De la Couperie, *The Western Origin of Chinese Civilization* (London, 1884); and Dyer Ball, *Things Chinese* (London and New York, 1893).

HWEI-SANG, hwā'säng' (c.420-c.505). A Buddhist monk, who traveled to the land Fusang, which has been identified by some with Mexico. In 499 Hwei-sang came to King Chow, the Imperial city of the dynasty of Tsi, and in 502 told the Emperor the story of his travels in Fusang, a country to the east, so called from a plant, the *fusang*. His story was taken down in writing; its principal point was that Fusang had been converted to Buddhism by monks from Cabul in 458. The identification of Fusang with Mexico was first made by De Guignes in 1761, in the *Mémoires de l'Académie des Inscriptions et Belles-Lettres*, vol. xxviii., and was laughed at. In later times (1862-63) Gustav d'Eichtal upheld the theory, and (1875) so did Charles G. Leland. (Consult his *Fusang, or the Discovery of America*.) But the strongest impetus given to this belief was by Vining, *An Inglorious Columbus* (1885), and by John Fryer (1901), in *Harper's Magazine* (vol. ciii., p. 251 sqq.), and in *Harper's Encyclopædia of United States History*, "Hui Shen," which should be consulted. He finds traces of Buddhist art in the idols of the Aztecs: of *lama* in the Aztec *tlama;* of *Gautama*, in *Guatemala*, *Huatomo; Guatemotzin;* of *Sakhya* in *Oaxaca*, *Zacatecas*, *Sacalepec*, *Zácatlan*, *Sacapulas*, and *Taysacca;* of a correspondence between *Fusang* from *fusang*, and *Mexico* from *maguey* (or agave); while he explains away all difficulties by mistakes in the report of Hwei-sang's story due to his imperfect knowledge of Chinese and by the changes wrought in Mexico by the invasions of the Spanish.

HYACINTH (from OF. *hyacinthe*, from Lat. *hyacinthus*, from Gk. *ὑάκινθος*, *hyakinthos*, hyacinth; of doubtful etymology, hardly connected with Lat. *juvenis*, Skt. *yuvan*, Eng. *young*), *Hyacinthus*. A genus of bulbous plants of the natural order Liliaceæ, with linear radical leaves and many flowers on leafless scapes. The blossoms are either erect, spreading, or drooping, and arranged in loose or dense racemes. The genus comprises about thirty species, of which three are natives of Southern and tropical Africa, and the rest of Asia Minor, Syria, and Persia. The few cultivated species are native to the region east of the Mediterranean Sea, and among them *Hyacinthus orientalis*, which has become naturalized in Southern Europe, is by far the most important. The numerous varieties have single and double flowers of many different colors. The hyacinth has long been in cultivation, and about the beginning of the eighteenth century it stood almost first in popularity among florists' flowers, and many new varieties were produced. Then, as now, Holland, owing to its favorable climatic and soil conditions, was the principal hyacinth-growing country. Hyacinths are grown in the open, under glass, and as house plants. For outdoor growth, a good, well-drained garden soil is required. Well-rotted cow manure is the best fertilizer for hyacinth-beds, and horse manure should never be used. Neither should the bulbs be brought in direct contact with freshly applied manure. The bulbs, planted from September to November, are usually placed from six to eight inches apart, and about five inches deep in beds spaded to the depth of twenty inches. The main root-growth is made during the fall. In winter the beds are protected with litter, leaves, or well-rotted manure. The plants flower early in the spring. In the summer when the leaves have withered, the bulbs are taken up and stored in dry soil or sand until planting time. For winter flowering the bulbs are started in the dark, and later on the plants are brought to bloom in the forcing house. As house plants, they are grown in hyacinth glasses with water only. Roman hyacinths are a form of *Hyacinthus orientalis* which produce three or four small flower-spikes instead of a single large one. Two other species, *Hyacinthus amethystinus*, or Spanish hyacinth, and *Hyacinthus ciliatus*, are also cultivated to a small extent. There are a number of other plants commonly called hyacinths, which belong to other genera of Liliaceæ. Among these are the grape or globe hyacinth and the musk-hyacinth of the genus Muscari; the *Hyacinthus candicans* of gardeners, which is Galtonia candicans; the wild or wood hyacinth of Great Britain (also called bluebell) is Scilla festalis. The water-hyacinth (*Eichhornia speciosa*), which occurs in American tropical and sub-tropical streams, often constitutes a hindrance to navigation. It belongs to the order Pontederiaceæ. See Colored Plate of AQUATIC PLANTS.

DUTCH HYACINTH.

HYACINTH. The brownish or reddish transparent variety of zircon, especially that found in Ceylon, frequently used as a gem. The name is also applied to similarly colored transparent minerals, chiefly to the hessonite variety of garnet.

HYACINTHE, ē'ä'säNt', PÈRE. See LOYSON, CHARLES JEAN MARIE.

HY'ACIN'THUS (Lat., from Gk. Ὑάκινθος). According to the usual story, the son of Amyclas, and beloved by Apollo. While throwing the discus the god accidentally struck and killed the boy. Later writers said that Zephyrus, also a lover of Hyacinthus, by his blast turned the discus from its course against Hyacinthus. His grave was shown at Amyclæ, and on the throne of the image of Apollo, which stood over the grave, was represented the reception of Hyacinthus and his sister into Olympus. The Hyacinthia, celebrated in his honor for three days each spring, were among the greatest Laconian solemnities, and Amyclæ the most sacred place in Laconia. From the blood of Hyacinthus sprang the hyacinth, with the lament AI on each leaf. This flower seems to be a species of iris; but is almost certainly not our hyacinth.

HYADES, hī'à-dēz (Lat. nom. pl., from Gk. Ὑάδες, rainy). In Greek mythology, nymphs of Dodona, associated with the fructifying effect of moisture. They were the nurses of the newborn Bacchus, and were rewarded by Zeus by being placed among the stars near the head of the Bull. Their number varies from two to seven. According to another account they were daughters of Atlas and Æthra or Pleione, and sisters of the Pleiades, and were changed into stars after their death from grief at the loss of their brother Hyas, who was killed by a snake. The rising of these stars in spring and autumn was looked on by the Greeks and Romans as a sign of wet weather. The name was sometimes rendered by the Romans *Suculæ*, little pigs, either by mistaken derivation from ὗς, sow, or because the Roman name, for which a derivation from *succus*, moist, has been assigned, existed independently of the Greek term.

HYÆ'NODON. An extinct dog-like creodont mammal, fossil skeletons of which have been found in the late Eocene and early Miocene terrestrial deposits of North America and Europe. It was the latest and most specialized member of the Creodonta. Its head is very elongate with a strong posterior crest, the lower jaw is long and slender, and the canine teeth of both jaws are prominent. The body was of slender build, the legs rather short, the feet semi-plantigrade, each foot with five clawed toes. The finest examples are from the White River formation of Nebraska, Montana, and Dakota.

HY'ATT, ALPHEUS (1838-1902). An American naturalist. He was born at Washington, D. C., and was educated at the Maryland Military Academy, at Yale College, and the Lawrence Scientific School, Cambridge, from which he graduated in 1862. He served as a volunteer throughout the Civil War, rising to the rank of captain. He afterwards renewed his studies, becoming curator of the Essex Institute in 1867. He was the principal founder of the American Society of Naturalists; organized a seaside laboratory at Amusquam, Mass.; took part in the organization of the Marine Biological Laboratory at Wood's Holl, Mass.; and assisted in the founding of the Peabody Academy of Sciences, and became its curator in 1869. He was also one of the founders of the *American Naturalist*. In 1870 he became custodian, and in 1881 curator, of the Boston Society of Natural History, and in 1881 was appointed professor of zoölogy and paleontology at the Massachusetts Institute of Technology and at Boston University.

He was elected a member of the National Academy of Sciences in 1875; was a corresponding member of the Geological Society of London; and in 1898 received the degree of LL.D. from Brown University, and was a vice-president of the American Academy of Arts and Sciences, Boston. His work as a paleontologist was masterly; besides making many innovations in the classification of the nautiloids and ammonites (q.v.), the final results form the most valuable contribution to the philosophy of biology. He was the founder of the new school of invertebrate paleontology. In systematic zoölogy he will be remembered for being next to the first one to refer the sponges to a distinct phylum. He also proposed many new genera, families, and numerous suborders of fossil cephalopods. He discovered the law of acceleration in the evolution of Cephalopoda, and the mechanical causes of their evolution; of his work on the fossil pond-snails of Steinheim and the origin of their various forms, Sir R. Owen wrote that it was "a model of the way and aim in and by which such researches should be conducted."

Hyatt wrote, besides many shorter articles: *Observations on Freshwater Polyzoa* (1866); *Revision of North American Porifera* (1875-77); "The Genesis of the Tertiary Species of Planorbis at Steinheim," in *Memoirs of the Boston Society of Natural History* (1880); *Genera of Fossil Cephalopods* (1883); *Larval Theory of the Origin of Cellular Tissue* (1884); *The Genesis of the Arietidæ* (1889). He has edited *Guides to Science Teaching*, and revised the part of the Zittel-Eastman *Text-book of Paleontology* on Nautiloids and Ammonoids. These works make him prominent among the new school of American zoölogists, led by Cope and Packard, which called itself 'Neo-Lamarckian.' Professor Hyatt died at Cambridge in 1902.

HYATT, JOHN WESLEY (1837—). An American inventor, born at Starkey, N. Y. His education was very meagre, and while yet in his teens Hyatt started upon his career as an inventor. His first important invention (1865) was that of a composition billiard-ball which, by reason of the scarcity of ivory, became very popular. Four years later, by his discovery of a means for dissolving pyroxylin under pressure, he laid the foundations for the present immense celluloid industry. Undoubtedly Hyatt's greatest contribution to science, however, was the scheme he devised in 1881 for the purifying of large bodies of water. The success of his method has been attested by the general use made of it both in the United States and abroad.

HY'BLA (Lat., from Gk. Ὕβλη). The name of two towns in Sicily. Hybla Major was situated on the seacoast, not far from Syracuse, and Hybla Minor at the foot of Etna. Both were originally cities of the native inhabitants, and were afterwards Hellenized. From one of these came the Hyblæan honey, rendered so famous by the poets.

HYBODUS, hĭb'ō-dŭs (Neo-Lat., from Gk. ὕβος, *hybos*, hump + ὀδούς, *odous*, tooth). An extinct genus of cestraciont sharks found fossil in the Triassic and Jurassic rocks. Finely preserved skeletons of this shark have been found in the Liassic deposits of England. These fish had blunt heads, jaws armed with nine to ten rows of sharp, conical teeth, fins armed with long, sharp, anterior spines, and the skin was covered with shagreen, consisting of small pointed plates. Two sharp curved spines on each side of the head behind the eyes are present on the males only, and perhaps served as offensive organs. The species varied from three to six feet in length. See SHARK.

HYBRID (from Lat. *hybrida, hibrida, ibrida*, hybrid), in plants. The progeny of parents which belong to different species or races. See HYBRIDITY.

HYBRIDITY. The phenomenon of the sexual crossing of two individuals belonging to distinct species. A hybrid is the product of this crossing, and is contrasted with a mongrel, or the product of individuals belonging to distinct races or varieties of the same species. The importance of hybridity is threefold:

(1) *A Test of Species.*—Hybridity has been used by Cuvier and others as a test of species, as contrasted with varieties. It has been asserted that hybrids are sterile, whereas mongrels are fertile. So long as infertility of descendants is used as a criterion of species, this tenet is unassailable; the difficulty arises from the fact that the strict application of the criterion leads us to deny specific distinctions to animals that are commonly regarded as such—e.g. the dog and wolf, dog and jackal, the hare and rabbit, various species of Bovidæ or oxen, sheep and goat, and, among plants, various forms of Rhododendron, Gladiolus, Dianthus, Nicotiana, etc. Focke says concerning plants: "Many hybrids, especially those between unlike lines of descent, are infertile, most show a diminished fertility, some a *nearly normal fertility*." It may be concluded, therefore, that the Cuvierian definition of species will not hold. While fertile hybrids are thus not common, the capacity for hybridization in the first generation is widespread.

The question arises, Why are hybrids so often sterile? Various hypotheses have been proposed, but none can be said to be proved. Darwin's hypothesis is thus summarized: "The sterility of first crosses and of their hybrid progeny has not been acquired through natural selection. In the case of first crosses it seems to depend on several circumstances; in some instances on the early death of the embryo. In the case of hybrids, it apparently depends on their whole organization having been disturbed by being compounded from two distinct forms, the sterility being closely allied to that which so frequently affects pure species when exposed to new and unnatural conditions of life. He who will explain these latter cases will be able to explain the sterility of hybrids. Wallace has a somewhat different view. A new species arises in connection with some slightly varying conditions of environment. If these are sufficient to create a change in coloration or form, they will, by virtue of correlation, affect also the germ cells, and may give rise to a certain amount of infertility. Now the infertility will be beneficial whenever new species arise in the same area with the parent form, because it would result in a destruction of both of the adapted forms. Consequently, whenever two species which are at the same time adapted and infertile arise, they will retain their respective adapted conditions and will survive. Finally, Catchpool and Romanes have independently suggested an explanation that is worthy of consideration—it is that the sterility of species is not something acquired, but is primary. Whenever from any cause two lots of individuals of one species become partly infertile *inter se,* those lots are, as it were, segregated. Each of them can develop its own way and give rise to a distinct species. If the species were not thus sterile at the beginning, differentiation would be difficult.

(2) *Relation to Inheritance.*—Hybridity is important for the study of the laws of inheritance. Since the parents are more unlike, the nature of their combinations is still more interesting than in the case of ordinary sexual reproduction. Hybrids are particularly apt to show a reversion to an ancestral condition, especially when opposing characters are intermingled. The following rules concerning hybrids have been formulated by Focke: (a) "All the individuals formed by the crossing of two pure species or races are, if they have been produced and grown under the same conditions, exactly like each other as a rule, or they differ hardly more than specimens of one and the same species are apt to do." This proposition is subject to many exceptions. In certain crosses the female element is predominant in the progeny; in others the male. Especially in cases of alternative heritage (see HEREDITY) the hybrids may be of two types, the one resembling more the one parent, the other type the other parent. (b) "The characteristics of the two crosses may be different from those of the parent species. They differ most from both parent species in size and luxuriance, as well as in fertility." In the case of alternative heritage an interesting rule was worked out by Mendel. He finds that one of the species is prepotent (p), the other subpotential (s). The hybrids will be either of the p or the s species, and the relative proportion will be p 75 per cent., s 25 per cent. If, now, self-fertilization occur, 50 per cent. of the plants will produce either p or s progeny in the proportions 75 per cent. p, 25 per cent. s. All the descendants of p and s breed true. The consequence of Mendel's 'law of dichotomy' in hybrids is that the proportion of the pure races is constantly increasing in the successive generations descended from a hybrid. "Malformations and curious forms are much more common, especially in the flower parts of hybrids, than in individuals of a pure descent." Double flowers appear to be formed especially easily in hybrids. Hybrids are frequently infertile, because the pollen is imperfectly formed.

(3) *Utility.*—Hybridity has great practical utility in agriculture. Many varieties of our domesticated plants have arisen from artificial hybrids. The first generation of hybrids usually gives few results, but great variations continue to appear in subsequent generations. Thus, when two species of hybrid foliaceous plants are crossed, the leaves of the second or third generation are often highly variable. This great variability, on the other hand, renders any favorable variation liable to be lost unless great pains are taken to fix the desired quality by in-and-in breeding, or unless the quality can be reproduced vegetatively—i.e. by cuttings and grafts. The diminished fertility of some hybrids is agriculturally advantageous in the case of plants that can be reproduced vegetatively. Some of the advantageous results of hybridization are as follows: (a) Increased Size and Vigor. The hybrid between the English walnut and the California black walnut is of exceptional value, "for it grows twice as fast as the combined growth of both parents. The wood is very compact, with lustrous silky grain," etc. Another hybrid of the black walnut and the California black walnut produces fruit of much larger size than that of either parent. These are illustrations of a common result of hybridization—increased size and vigor. (b) Increased Hardiness. The production of hardy races of plants is very important, because it carries farther north the limits of agriculture and increases the area of cultivation. Every few years the orange and lemon trees of the Gulf States and California are greatly damaged by freezing weather. The Japanese trifoliate orange is hardy, but has fruit of small size. It is hoped that a hybrid may be obtained between it and the ordinary orange which shall have increased hardiness without loss of size or flavor in the fruit. (c) Adaptation to Warmer Climate. The Kieffer and LeConte pears, which have revolutionized pear agriculture by extending the range of profitable pear-growing hundreds of miles southward, are said to be hybrids between the common pear and the Chinese sand pear. (d) Increased Resistance to Disease. When the vast grape industry of France was threatened with destruction on account of the ravages of the bug Phylloxera, immune American species were crossed with the French species and immunity was gained by them. Similarly, the black-rot disease in grapes has been fought by introducing the blood of immune races. (e) Increased Percentage of Starch, Sugar, etc. By hybridization the production per acre of the potato has been doubled, and the starch percentage increased from 15 to 26. While the percentage of sugar in the sugar-beet has been hitherto chiefly increased by selection, there seems to be a chance for improvement by hybridization. A hybrid cinchona produces three to four times the ordinary percentage of quinine. (f) Change of Season and Duration of Life. By hybridization plants have arisen fruiting at unusual times, like Burbank's blackberry and raspberry hybrids. A fairly successful attempt to make the pansy perennial resulted from crossing the garden pansy with the perennial Viola cornuta. (g) Acquisition of Odor. The fragrance of the pansy has been improved by crossing with odoriferous Alpine species. (h) Improvement of Quality and Flavor. This result is illustrated by the case of smoking tobaccos, in which the superior-flavored Havana race has been crossed with other races having larger leaves, so that a greater quality of well-flavored leaf has been produced. Alto-

gether, many breeders conclude that by systematic hybridization most species of plants will be found capable of almost indefinite improvement.

In connection with the artificial production of hybrids, the phenomenon of 'xenia' has recently attracted much attention. This term is applied to cases in which characters of the pollinating parent appear directly in the fruit or seed. It was once thought that only the embryo could show hybrid characters, which would become evident, therefore, only upon the germination of the seed. In cases of xenia, however, the regions of the seed outside of the embryo show hybrid characters, so that it is evident that they too have been influenced by the pollinating parent. The crossing of the races of maize has proved to be most favorable for studying this phenomenon. If a race of maize normally producing white grains be pollinated by one producing red grains, the resulting grains will show the red coloration in various ways. The same result is also obtained in crossing races of sweet and dent corn. This phenomenon was inexplicable until the recent discovery of 'double fertilization' among flowering plants. This phrase means that both of the male cells were brought by the pollen-tube to the ovule function—one fertilizing the egg, which then produces the embryo, the other uniting with the 'endosperm nucleus,' which then produces the endosperm or food substance of the seed about the embryo. It is evident, therefore, that where double fertilization occurs in connection with hybridizing, the endosperm as well as the embryo is a hybrid, and that the resulting seed may show characters of the pollinating parent. See ANGIOSPERMS; FERTILIZATION; PLANT-BREEDING.

METHODS OF HYBRIDIZING.—The methods of hybridizing plants are simple. If the flower is hermaphroditic its stamens must be cut away before they are ripe—usually before the corolla opens—and the flower must be tied up in a paper bag. When the stigma is ripe the pollen is placed on it, and the bag tied over the flower again and not removed until the seed begins to form. If the flower bears no stamens, it requires, of course, no operation except the tying up while in the bud to prevent the access of foreign pollen. Among animals, much less experimentation in producing hybrids for commercial purposes has been done.

HYBRIDITY IN ANIMALS.

The number of animal hybrids known to have been produced or to actually exist is not large. The only special work on hybrids is that of Suchetet, the first volume (1001 pages) being devoted to birds alone.

Of hybrids produced by nature we have on record comparatively few examples, but the number is probably quite considerable. It is known that fish, especially the Salmonidæ, readily hybridize. There are on record over a hundred cases of hybrids among insects, and the number probably runs into the thousands. Of amphibians, species of diverse frogs have been seen mating, but it is not definitely known that such unions have given rise to hybrids. Natural hybrids among birds have been described—e.g. between the flicker of the Eastern United States and the Mexican flicker, between two species of warblers of the genus Helminthophila, between species of geese, various European grouse, and certain Asiatic pheasants.

HYBRIDS PRODUCED ARTIFICIALLY. By artificial fertilization of the ova of different species, and even genera and families, of sea-urchins, the early larval stages have been reared, but never carried to maturity; the resulting pluteus stages are more or less monstrous. In one case early larval hybrids between species of two different classes of echinoderms, starfish and sea-urchins, were produced. The cases of fertile hybrids of birds and mammals mentioned below were produced in captivity; besides these there have been instances of hybrids between the brown and polar bear, the leopard and jaguar, the lion and tiger, the sea-lion and fur-seal, between the zebra and horse, the horse and ass, and the common ass and varieties of the kiang.

Hybrids are also known to occur between the dog and fox (Darwin), but this case is doubted by Ewart.

VARIATIONS OF HYBRIDS. Darwin has shown that hybrids are more variable and have a greater tendency to vary than the products of pure race of both parents. He also has shown that the products of hybrids are much more variable than the hybrids themselves.

RESULTS OF RECENT EXPERIMENTS. As a result of experiments by Standfuss on thousands of specimens of the higher Lepidoptera, the following results have been obtained:

(1) The intercrossing of two species may result in anything, from complete sterility to the production of the normal number of fertile eggs. These extremes may even occur as the result of crossing different individuals of the same two species. Hence a cross must not be pronounced infertile on the evidence of a single failure.

(2) Individual differences in the structure of the genital apparatus may prevent effective crossing between some members of two given species, though other members of the same two species may pair freely.

(3) Some crossings have resulted entirely in male, others entirely in female, offspring. A third class has given both sexes in various proportions.

As regards the fertility of hybrids, in no case observed by Standfuss or known to him has the female of a true hybrid been shown to be fertile. But the occurrence of undoubted cases of fertility in male hybrids has been proved by crossing the male hybrids with the females of both parent species, and in one case with the female of a third species.

The silk-moth hybrids of Philosamia cynthia and Philosamia ricina, the arrhindy moth, two closely allied species, are also said to have been fertile for eight generations.

FERTILITY OF THE HYBRIDS. It is well known that the mule is infertile, and though there are reported to be three cases where a mule has produced young, they are doubtful. Ewart, in referring to the instance of the Paris Jardin de l'Acclimatation mule, doubts whether these animals are mules, quoting Ayrault's opinion that the Paris mule was an ordinary mare. Darwin states that he knows of no thoroughly well authenticated cases of perfectly fertile hybrid animals, though he adds: "I have reason to believe that the hybrids from Cervulus vaginalis and Reevesii and from Phasianus colchicus with Phasianus torquatus are perfectly fertile." The hare and rabbit are supposed to have fertile offspring; the hybrids of the common and Chinese geese (*Anser cygnoides*) are fertile, as are hybrids between the common duck and the pintail duck. The crossed offspring from the Indian humped and common cattle interbreed. Caton has hybridized the Virginia deer with the Ceylon deer and the Acapulco deer, and says that the hybrids seem perfectly healthy and prolific. The Indian dog and coyote are said by Coues to interbreed, and on the upper Missouri dogs have been seen having every appearance of being such hybrids. Hybrids of hares and rabbits have continued fruitful for generations; the same is true, says Hertwig, of hybrids obtained from the wild buck and the domesticated she goat. The American bison is known to breed with the domestic cattle, and it seems to be a well-established fact that the hybrids are fertile. Ewart states that the Indian buffalo and the American bison produce fertile hybrids with the wild ox of Europe. Among fishes, fertile hybrids have been obtained from the carp and goldfish, and from the charr and the brook trout.

Relative Strength of Hereditary Influences. The three following conclusions rest on an elaborate series of experiments by Standfuss with three European species of Saturnia moths:

(1) The freshly hatched hybrid larva closely resembles that of the female parent, but with the process of growth a resemblance to that of the male parent gradually increases.

(2) The extent of approximation toward the male parent depends on the relative phylogenetic age of the two species, the older being able to transmit its properties, whether of structure or habit, better than the younger.

(3) In reciprocal pairing, the male is able to transmit the characters of the species in a higher degree than the female. This influence, however, is less regular and potent than that spoken of in the preceding paragraph.

The result of crossing a parent species with a local race, or with an aberration of the same species, is as follows:

(1) When the normal form of a species (*Grundart*) is crossed with a gradually formed local race of the same species, the result is a series of intermediate forms. (2) On the other hand, when the normal form is crossed with a sporadic aberration, the result in many cases is that the issue divides itself sharply between the normal form and the sport, intermediate forms being absent.

In commenting on these results, Dr. F. A. Dixey remarks: (1) The experiments afford fresh illustrations of the manner in which the physiological isolation of an incipient species may be brought about. (2) They show that the statement of Focke as to the great variability of the offspring resulting from the crossing of a plant hybrid with one of the parent species holds good in the case of insects. (3) What Standfuss speaks of as the prepotency of the phylogenetically older of the parent species is probably only another expression of the principle established by Darwin that in many cases crossing causes reversion to a remote ancestor. (4) The general conclusion as to the prepotency of the male parent accords so far with one result of Galton's investigation of the late Sir E. Millais's breed of basset hounds. (5) The result of crossing a parent species with a gradually formed local race, though less in degree, is much the same in kind as that of crossing two distinct species. (6) The result of crossing the normal form of a species with a sporadic aberration of the same species appears to show that the latter stand biologically on an entirely different footing from the regularly developed variety, even though it may indicate (as alleged by Eimer and by Jordan) the direction in which variation for that species is possible. With Standfuss's instances may be compared the well-known case of the 'otter sheep,' which similarly, when crossed with a sheep of ordinary breed, gave no true intermediates. (7) Certain experiments with aberrations of this kind, of which exact numerical records have been kept for several generations, are of special interest in connection with Galton's law of heredity. See Galton, *Natural Inheritance*, p. 134 (London, 1889).

In still later experiments by Standfuss (1898) he shows that the crossing of two distinct species gives rise to a *zwischenform*, but not to a *mittelform*. The latter may, however, exist as a temporary stage in larval growth. This depends on the following principles: (1) The freshly hatched larva closely resembles the female parent; (2) with the process of growth a resemblance to the male parent gradually increases; (3) the final extent of approximation toward the male parent depends on the relative phylogenetic age of the two species, the older being able to transmit its properties, whether of structure or habit, better than the younger; (4) in reciprocal pairing the male is able to transmit the characters of the species in a higher degree than the female; (5) when the normal form of a species (*Grundart*) is crossed with a gradually formed local race of the same species, the result is a series of intermediate forms; (6) when the normal form is crossed with a sporadic aberration, the result in many cases is that the issue divides itself sharply between the normal form and the sport, intermediate forms being absent.

Hence, according to Standfuss, adds Dixey, "the process of species formation must be gradual; for when two distinct species are crossed the issue does not split up into two parental forms, as in the case when one parent is a suddenly formed aberration. On the contrary, the behavior of the issue of two distinct species is very similar in kind to that of a species crossed with a local race or variety which is being gradually established by the accumulation of slight changes. It would seem, therefore, that although an aberration or sport may be perpetuated by inheritance, it can never acquire distinct specific rank. No doubt, however, it may, if selected, eventually replace the original form of the species."

Dixey also makes the interesting suggestion that these sporadic color aberrations "seem to have many points of resemblance with the color varieties in domestic animals, such as the 'lemon and white' and 'tricolor' of the basset hounds, or the well-known tortoise-shell, tabby, and black of cats. The fact that these domestic varieties exist side by side in the same race, and even in the same litter, and that true intermediates are rare or absent, seems to suggest that they originally appeared as sports, and that their perpetuation has been insured or favored by artificial selection."

Zebra Hybrids. In his *Penycuik Experiments* (1899) Ewart states that he bred nine zebra hybrids by crossing mares of various sizes and breeds with a Burchell zebra stallion 'Matopo.'

The hybrids are interesting because of the curious blending of characters, derived apparently partly from their actual and partly from their remote ancestors, and because they shed new light on many questions of general interest, such as the origin of stripes, reversion, interbreeding, and prepotency.

Reversion. He concludes that "some of the hybrids in make and disposition strongly suggest their zebra sire, others their respective dams; but even the most zebra-like in form are utterly unlike their sire in their markings. It is not a matter of taking after a grandparent, but after an ancestor in all probability thousands of generations removed, an ancestor probably far more like the Somali than any of the Burchell zebras." (This confirms Standfuss's conclusion stated above.) Ewart adds (p. 21): "The reversion may be to recent, remote, or intermediate ancestors, and the tendency will in most cases be to revert to sports that here and there mark the route along which the development has proceeded."

He also, by breeding pigeons, restored the rock pigeon, or primitive form. "In the case of my most typical bird there is, as far as an external examination can show, practically complete reversion." Reversion, he says, "seems to lead to a form of rejuvenescence." He regards polydactylism in the horse as in part due to reversion to the Hipparion or the three-toed fossil horse. As he well puts it, the cases of reversion that he cites "must be more or less accurate restorations of their comparatively remote ancestors." Reversion also indicates that in some cases "varieties and breeds which have, through interbreeding, undergone senile degeneration, may be regenerated without the loss of their best and most prized characteristics."

Prepotency. It is generally assumed that an old species or variety is prepotent over a more recent species or variety. It is impossible to say whether zebra hybrids in their markings take after a remote zebra ancestor, or after an ancestor common to both zebras and horses, or after a hypothetical mid-parent combining the characters of the less remote ancestors of both zebras and horses. There is, however, no difficulty in seeing that while some zebra hybrids, apart from their stripes, closely resemble the zebra parent, others take after their horse parent, thus showing that the wild sire is not necessarily the most prepotent. "But even when the hybrids are distinctly horse-like they never repeat recently acquired peculiarities, such as a blaze, or short ears, high withers, or a small head and long neck."

He believes that sports and certain marked variations are often prepotent; and also that inbreeding (see **Cross-Fertilization**) is "common among wild animals, and that by inducing prepotency it plays an important part in the origin of species." It may be here observed that Ewart's experiments lead him to reject telegony (q.v.), and to explain such occurrences by cases of reversion. The zebra hybrids are also interesting as being "in some respects almost intermediate between their parents." Each parent, he says, hands on its most fixed individual characters. His zebra hybrids are neither new creations nor yet intermediate forms.

Sterility in Hybrids.—Ewart concludes that, as there is no hard and fast line between species and varieties, there can be "no fundamental difference between a hybrid and a cross, nor yet any *a priori* reason why any given hybrid should be sterile, or any given cross fertile." "Sterility has doubtless been acquired in some cases slowly, in others abruptly, but how it has been acquired it is impossible in most cases even to guess."

Mendel's Law. Great interest has been excited among biologists by Mendel's law, and his discovery of certain principles of heredity which will prove of much practical value to breeders of plants and animals, and lend a new phase to the theory of heredity and also of evolution, since the results thus far obtained point to discontinuing evolution and the absence of intermediate forms. Mendel's original paper was published at Brünn, Austria, in 1865, but was overlooked until De Vries in 1900 published an exact counterpart of Mendel's theory, while Correns and also Bateson hit upon the same law. As stated briefly by Spillman, it is as follows: In the second and later generations of a hybrid, every possible combination of the parent character occurs, and each combination appears in a definite proportion of the individuals. A parent character which is fully developed in the hybrid is said to be 'dominant;' if it is apparently absent it is said to be 'recessive.' A case in illustration is thus stated by Bateson: "In breeding crested canaries, the kind of crest desired for exhibition can, according to canary-fanciers, be produced most easily by mating crested birds with non-crested, or 'plain-heads,' as they are called. If it be supposed that the crested character is usually dominant, we have a simple explanation. When crested birds are bred together, a number of birds are produced whose crests are coarse and stand up, and others without crests. The latter are the recessives; the former we may suppose to be the pure dominants." The fact that the hornless breeds of goats will give off some horned offspring is probably due to the fact that they are what Bateson terms 'heterozygotes,' under what is usually called 'reversion.' From the analogy of cattle, it may be anticipated that the hornless form is dominant. Consult Bateson, *Mendel's Principles of Heredity*, with a translation of Mendel's original papers on hybridization (London, 1902).

Mendel's more important discoveries are also thus stated by Castle: "(1) His law of dominance; when, for example, the offspring of two parents differing in respect of one character all resemble one parent, and possess therefore the dominant character, that of the other parent being latent or recessive. (2) In place of simple dominance, there may be manifest in the immediate hybrid offspring an intensification of character, or a condition intermediate between the two parents; or the offspring may have a peculiar character of their own (heterozygotes). (3) A segregation of characters united in the hybrid takes place in their offspring, so that a certain per cent. of these offspring possess the dominant character alone, a certain per cent. the recessive character alone, while a certain per cent. are again hybrid in nature."

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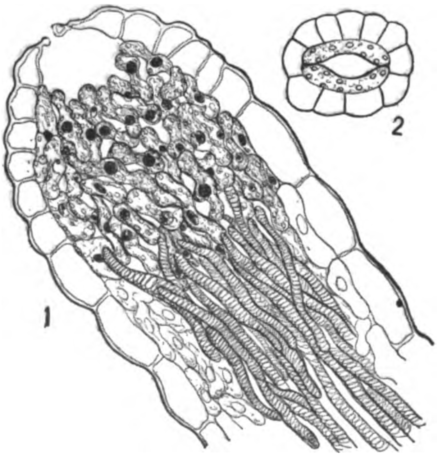
HYBRIDIZING. See Plant-Breeding.

HYDAS'PES. The ancient name of the river Jhelam, in Northwestern India. See Jhelam.

HYDATHODE, hī'dăth-ōd (from Gk. ὕδωρ, *hydōr*, water + ὁδός, *hodos*, way). In botany an organ that exudes water. Usually hydathodes occur at the tips of the main veins or branch veins of leaves, and commonly appear to the unaided eye as leaf-teeth. At the apex of the organ is a pore which has been variously called water-pore and water-stoma. These pores differ from ordinary stomata in the absence of turgor movements, often in size and in their function; they are passageways for liquid water rather than for water vapor. Hydathodes commonly occur in connection with the vascular system, and may be regarded as a sort of safety apparatus to prevent injection of the air-space with water at times when root-pressure is high and transpiration low.



(1) Longitudinal section through leaf-tooth of Chinese primrose (*Primula Sinensis*), showing the divergent tracheids, terminating the vascular bundle, the loose epithem, and the terminal pore.
(2) Surface view of a water-stoma (terminal pore of a leaf-tooth).

HY'DATID (Gk. ὑδατίς, *hydatis*, water-vesicle, hydatid, from ὕδωρ, *hydōr*, water; connected with OChurch Slav. *voda*, Skt. *udan*, water, and ultimately with Goth. *watō*, OHG. *wazzor*, Ger. *Wasser*, AS. *wæter*, Eng. *water;* AS. *wæt*, Eng. *wet;* OHG. *ottar*, Ger. *Otter*, AS. *otor*, Eng. *otter*). The bladder-worm. It is allied to the tapeworm, but differs in being bladder-like, and similar in shape to the 'cysticercus' of the tapeworm. The heads bud on special brood-capsules in such a way that their invagination is turned toward the cavity of the vesicle. About 5000 eggs are developed in a single segment (proglottis). The six-hooked embryos develop, are expelled from the dog, the first host, and find their way in drinking-water or in food into the human intestines, whence they bore into the liver, their favorite habitat, or are carried along the blood-vessels into some other organ, where they develop into bladder-like bodies or 'hydatids' (*Echinococcifer echinococcus*). By the fourth week the young is ½ mm. (1-50 inch) in length, and it is probably many months before the echinococcus heads are entirely developed. The worms become sexually mature in from seven to nine weeks after this stage is reached, when the milk-white worms may usually be found imbedded in the mucus of the duodenum and upper part of the small intestines, with their heads attached to the villous surface of the intestine. The parent vesicle may grow as large as a man's head. The cyst in which the bladder-worm lies, and which is caused by it, is called a 'hydatid cyst.'

There are two forms of this hydatid, one (*Echinococcifer hominis*) living in man, and the other (*Echinococcifer veterinorum*) in domestic animals. When these echinococcus cysts remain sterile, as they frequently do, they are called 'acephalocysts.' "Another, and indeed pathological form," says Sedgwick, "is the so-called 'multilocular' echinococcus, which was for a long time taken for a colloid cancer. It is also found in mammalia (in cattle), and here presents a confusing resemblance to a mass of tubercles. The echinococcus disease (*hydatid plague*) was widely spread in Iceland. This disease, likewise, seems endemic in many places in Australia."

HYDE. A manufacturing town in Cheshire, England, seven miles east-southeast of Manchester (Map: England, D 3). Since the extension of the cotton trade, it has rapidly increased in size. Besides numerous cotton factories, print and iron works, there are considerable manufactures of machinery and hats. Coal abounds in the neighborhood. The neighboring district is densely peopled, and has abundant means of communication, by railway and canal, with all the important towns in the vicinity. Hyde is mentioned as a village in the reign of King John; it was incorporated as a municipal borough in 1881. It owns its water, markets, cemetery, and maintains free baths, library, hospital, and fire brigade. Refuse is consumed by a destructor, and sewage is chemically treated for fertilizing purposes. Population, in 1891, 30,700; in 1901, 32,800.

HYDE, Anne (1637-71). The first wife of James II. of England. She was the eldest daughter of the Duke of Clarendon, and was born at Cranbourne Lodge, the house of her grandfather, Sir Thomas Aylesbury, in Windsor Park. When she was twelve years old she went to Holland with her mother and sisters, and in 1654 was appointed maid of honor to the Princess of Orange, at whose Court she was a great favorite. It was while accompanying the Princess on a visit to Paris in 1656 that she first met James, then Duke of York. She became engaged to him about a year before his return to England in the spring of 1660, and in spite of the most vehement opposition from all quarters, was privately married to him in September. Her father disapproved of the affair with great ostentation, and afterwards, with more sincerity perhaps, attributed his downfall to the match. At first the royal family would not recognize her, and fruitless attempts were made, by attacking her character, to influence the Prince to put her aside. Although they were more or less prone to quarrel, Anne even being accused of poisoning one of her husband's mistresses, she influenced him for good in many ways. She was an accomplished and attractive woman, though not by any means handsome, and she maintained her position with regal dignity. She joined the Roman Catholic Church soon after 1667, and converted her husband to that faith. Her daughters, however, were educated as Protestants. Anne and Mary, who became Queens of England, were her only children that lived beyond infancy.

HYDE, Douglas (1860—). An Irish scholar and writer, son of the Rev. Arthur Hyde of Frenchpark, County Roscommon. He was educated at Trinity College, Dublin. In 1891 he was interim professor of modern languages in the State University of New Brunswick, and he was afterwards made examiner in Celtic to the Royal University of Ireland.

Hyde early took up the study of Irish literature, and in particular the collection and publication of Gaelic songs and folk-tales, and his labors in the preservation of native folk-lore constitute his most valuable services to Celtic scholarship. His *Literary History of Ireland* is noteworthy as being really the first attempt to write a comprehensive and systematic history of Gaelic literature. He is a skillful writer of prose and verse in both English and Gaelic, and under his assumed name, 'An Craoibhin Aoibhinn,' he is well known among the Irish-speaking people. His translations of modern Gaelic lyrics are often particularly happy in rendering at once the simple feeling and the complicated metrical structure of the native poetry. He took a prominent part in the organization of the popular movement for the preservation of the Irish language. He was made president of the Gaelic League (q.v.) in 1895, and of the Irish Text Society at its foundation. In 1894-95 he was president of the Irish National Literary Society. He was also made a member of the Royal Irish Academy. His principal works are the following: *Leabhar Sgeuluigheachta* (1889); *Cois na Teineadh: or Beside the Fire* (1891); *Love Songs of Connaught* (1894); *The Three Sorrows of Story-Telling* (1895); *The Story of Early Irish Literature* (1897); *An Sgeuluidhe Gaodhalach* (1898-99); *A Literary History of Ireland* (1899); *The Lad of the Ferule*, etc. (vol. i. of the publications of the Irish Texts Society, Dublin, 1899); and *Ubhla de'n Chraoibh* (1900). Part of his *Songs of Connaught* were contributed to the Dublin *Nation*. In the same way his edition of the *Poems of Raftery* has been published in the Dublin *Weekly Freeman*.

HYDE, Edward. See Clarendon, Edward Hyde, Earl of.

HYDE, Edward (c.1650-1712). A Colonial Governor of North Carolina. He was appointed by the proprietors to be Governor of the Albemarle District in the Province of North Carolina, but on his arrival in August, 1710, found that the Governor of the Province, from whom he was to receive his commission, had died, and that a former Deputy Governor, Thomas Carey, was leading an insurrection. A number of the more respectable residents requested Hyde to assume the office of Governor, which he did, and with the aid of Governor Spottswood of Virginia succeeded in putting down Carey's rebellion. Soon after, however, the North Carolina Indians, led by the Tuscaroras, went on the war-path and massacred many of the settlers. Hyde called on the neighboring Colonies of South Carolina and Virginia for aid, and on January 28, 1712, a body of South Carolina and North Carolina militia under Colonel Barnwell defeated the Indians on the Neuse River, about twenty miles from Newbern. Before these Indian troubles were settled Governor Hyde died, during an epidemic of yellow fever.

HYDE, Thomas (1636-1703). An English Orientalist, born at Billingsley in Shropshire. Educated at Cambridge, he was an assistant to Walton in an edition of his *Polyglot Bible*. Besides correcting the Arabic, Syriac, and Persian texts, he transcribed in Persian characters the Persian translation of the Pentateuch which had been printed in Hebrew letters at Constantinople, and appended a Latin version of his own. In 1658 Hyde entered Queen's College, Oxford, to which he was shortly after made Hebrew reader. In the following year, after graduating as M.A., he was chosen under-keeper and finally librarian-in-chief of the Bodleian Library. In 1660 he was made a canon of Salisbury; in 1678 archdeacon of Gloucester. He succeeded Pococke in 1691 as Laudian professor of Arabic; and soon after, on the deprivation of Altham, became regius professor of Hebrew and Canon of Christ Church. Worn out by his unremitting labors, he resigned his librarianship in 1701, and died at Oxford. Hyde's most important work was the *Historia Religionis Veterum Persarum eorumque Magorum* (1700; 2d ed. 1760). A number of other works were collected and published in 1767 under the title *Syntagma Dissertationum et Opuscula*.

HYDE PARK. An inclosure of nearly 400 acres in London, England, about two and one-quarter miles west of Saint Paul's Cathedral (Map: London, E 6). It derives its name from Hyde Manor, which belonged to the Abbey of Westminster. It became the property of the Crown on the dissolution of the monasteries, in the reign of Henry VIII. Ben Jonson speaks of the show of coaches which it presented in his time; and it was constantly resorted to on the morning of May Day for the sports comprehended under the term Maying. In the seventeenth century it contained deer; races, military reviews, and duels were held there. After the Restoration it became the favorite drive and promenade which it has ever since continued to be. It also serves as the place of large popular meetings. It has nine carriage entrances, and among its prominent features are: the Serpentine, an artificial sheet of water constructed by order of Queen Caroline in 1730, Rotten Row, the Ladies' Mile, the Marble Arch, the Hyde Park corner gateway, and the colossal statue of Achilles, erected in honor of the Duke of Wellington.

HYDE PARK. A town in Norfolk County, Mass., including the villages of Readville, Clarendon Hills, Hazlewood, and Fairmount; eight miles from the State House, Boston; on the Neponset River, and on two divisions of the New York, New Haven and Hartford Railroad (Map: Massachusetts, E 3). It has a public library of over 14,000 volumes; and extensive manufactures of cotton, woolen, and rubber goods, paper, dyestuffs, looms, morocco, tools and machinery, and curled hair. Hyde Park was incorporated in 1868; its government is administered by town meetings. Population, in 1890, 10,193; in 1900, 13,244.

HYDE PARK. A village in a town of the same name, and the county-seat of Lamoille County, Vt., 28 miles north of Montpelier; on the Lamoille River, and on the Boston and Maine Railroad (Map: Vermont, D 3). It is the centre of a farming and lumbering district, which also possesses considerable mineral wealth, and has extensive leather interests. Population (village), in 1900, 422; (town), in 1890, 1633; in 1900, 1472.

HYDERABAD, more properly, **HAIDARABAD**, hī'dẽr-ȧ-bäd′, or Nizam's Dominions. A large native State of southeastern India, bounded on the north by Berar and northeast by the Central Provinces, on the southeast by Madras, and on the west by Bombay (Map: India, C 5). Area, 82,698 square miles. The surface is an elevated plateau 1800 to 2000 feet above sea-level, diversified by mountain, valley, and plain, and watered by the Godavari with its affluents the Dudna, the Manjara, and Pranhita; the Kistna with its affluents the Bhima and Tungabhadra; and the Wardha with its affluents the Painganga and Wainganga. The climate is fairly healthful; the annual precipitation registers 28 to 32 inches. The geological formation is a base of granite, gneiss, and talc slate, superimposed by clay, limestone, sandstone, hornblende, feldspar, and in some districts columnar basalt. Iron and coal are mined, and gold, garnet, and diamond beds, which formerly supplied the Golconda treasury, still exist, although modern mining operations for the precious minerals have hitherto been unremunerative. The soil is comparatively fertile, but sparsely cultivated. Cotton, maize, wheat, millet, and rice are the chief agricultural products, and tobacco, sugar-cane, and indigo are also grown. Fruit culture, market gardening, pasturage of cattle and of sheep, and horse-breeding are other agricultural branches. Bad seasons, notably in 1900, have resulted in famine. There are domestic manufactures of silk, woolen and cotton fabrics, carpets, and leather. Raw silk, cotton, hides, dyestuffs, gums, and resins are exported, and cereals, cloth goods, hardware, salt, and timber are imported. Good military roads traverse the State, and in 1901 there were 715 miles of railroad open. The ruler of Nizam is a Mohammedan, as are also the Government officials, although the subjects are chiefly Hindus. There is a British Resident and adviser at Hyderabad, the capital. The annual revenue is about 39,000,000 rupees. The population, in 1891, was 11,537,040; in 1901, 11,141,142, or 135 to the square mile; of the population in 1901, 9,870,839 were Hindus; Mohammedans numbered 1,155,750; Christians, of whom half were Roman Catholics, 22,996; Jains, 20,345; Sikhs, 4335; and Parsis, 1463. A native army is maintained, consisting of 7660 men, infantry, artillery, and cavalry, officered by British soldiers. Education made considerable progress during the latter decades of the last century; but only a small per cent. of the children attend school, and the mass of the population is illiterate.

Hyderabad, formerly attached to the dominions of the Rajahs of Terlingana and Bijanagur, in 1512 became a separate kingdom, but in 1687 lapsed into a province of the Mogul Empire. In 1730 Azaf Jah, one of Aurungzebe's warriors, was nominated Nizam-ul-Mulk—Regulator of the State—and Subahdar of the Deccan, and eventually made himself independent. After his death in 1748, the throne was contested by his son, Nazir Jung, supported by the British East India Company, and his grandson, Mirzafa Jung, whose cause was espoused by the French under Dupleix. The latter triumphed until Mirzafa was murdered by Patan chiefs. Anarchy reigned until Nizam Ali, who ascended the throne in 1761, was defeated by the British, and signed the Treaty of 1766, which ceded the Northern Circars to the East India Company. The subsequent misrule of Nizam Ali's successors increased the territorial debt, which was liquidated by a further cession of land to the East India Company, with the stipulation that part of the revenues should maintain the Nizam's contingent, a subsidiary force of 8000 men for the protection of his dominions. During the mutiny of 1857 an unsuccessful attack was made on the British Residency at Hyderabad; the Nizam and his troops, however, remained faithful to the British, and the State has since been distinguished for its loyalty to the Imperial power. Consult Grible, *The History of the Deccan* (London, 1896).

HYDERABAD, or HAIDARABAD. The capital of the Nizam's Dominions, India. It stands on the Musi River, in latitude 17° 22′ N., and longitude 78° 32′ E., 1800 feet above the sea (Map: India, C 5). It is an important railroad and commercial centre, and its well-stocked and extensive bazaars are particularly picturesque. The splendid building of the British Residency stands on the opposite side of the river, the stream being here bridged by nine spacious arches of squared granite connecting the Residency with the Nizam's palace. The city is surrounded by a fortified wall six miles in circuit. The most conspicuous building is the principal mosque, fashioned after the model of the Kaaba at Mecca; while at the meeting of the four principal streets of the city rises another remarkable edifice, the Char Minar or College with four minarets, resting on connected arches, through which run the four converging thoroughfares. Water is supplied from huge tanks, one of which, close to the British cantonment of Secunderabad, measures three miles by two; another is said to be 20 miles round. The city owns its water-works, and maintains schools, a hospital, and pleasure grounds with a zoölogical section. Population, with suburbs, in 1891, 415,039; in 1901, 448,466.

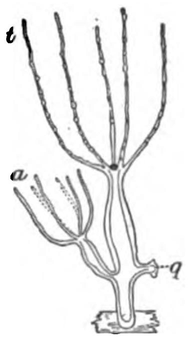
HYDERABAD. The chief city of a district of the same name in the Sindh Division, Bombay, British India, four miles east of the left bank of the Indus (Map: India, A 3). The ancient capital of the Sindh Kingdom, it has been famous from earliest times for its manufactures, including arms of various kinds, lacquered ware, gold and silver articles, and silks. It is an important railway junction and commercial centre. The chief object of interest is the fort commanding the town. It covers an area of 36 acres. A modern section of the town has fine wide streets, public buildings, and a market place. The cantonments containing model barracks are to the northwest of the town. Population, in 1891, 58,048; in 1901, 69,378.

HYDER ALI, hī′dēr ä′lē (more accurately, *Haidar 'Ali*) (c.1720-82). Ruler of Mysore, and one of the greatest Mohammedan princes of India. He is said to have been originally a sepoy in the French Army, which may explain the friendship which he always felt for the French. He won the favor of the minister of the Rajah of Mysore by the valor which he displayed at the siege of Trichinopoly in 1749, and, by a rapid rise not infrequent in the East, soon became the power behind the throne. Hyder Ali, in 1759, dispossessed his master, allowing him, however, to retain his title, while he himself took that of *daïva*, or regent. He then conquered Calicut, Bednor, Kananur, and other neighboring States; and in 1766 his dominions included more than 84,000 square miles. He waged two wars against the British, in the first of which (1767-69) he was completely successful, although deserted by his confederate Nizam Ali, a former friend of the English, and a treaty of peace was signed under the walls of Madras. According to the terms of this treaty, as he claimed, Hyder Ali asked the English in 1772 to help him against his old foes, the Mahrattas, who had already defeated him in 1764, but his request was refused. When a conflict broke out between the English and the French in 1778, he sought his revenge. With his son, Tipu Sahib, he entered the Carnatic in 1780, and proceeded to devastate it. After inflicting two severe defeats on the English, he was routed by Eyre Coote at Porto Novo. Two years later he died very suddenly. Consult Bowring, *Haidar Alí and Tipú Sultán*, Rulers of India Series (Oxford, 1893).

HYDRA, hē′drȧ *or* ē′drȧ (Lat. *Hydrea*, Gk. '*Υδρέα*). An island of Greece, situated off the eastern coast of Morea, from which it is five miles distant (Map: Greece, E 4). It is about 11 miles long and three miles broad, and has an area of 22 square miles. The shores are rocky and steep, and the interior, rising to about 1800 feet in height, is destitute of vegetation and of water. On the northwest coast is the town and seaport of Hydra, the white, flat-roofed houses of which are ranged on the side of a hill. The streets, owing to the irregularity of the site, are steep and uneven, but remarkably clean. In ancient times the island of Hydra was a dependency of the city of Hermione, and was later ceded to the Trœzenians. During the fifteenth and sixteenth centuries it was settled by fugitives from Albania, Argolis, and Attica. In the Grecian War of Independence the Hydriotes took a most active part, and none were more liberal in their contributions to the patriotic cause. In 1825 the population was estimated at 40,000. At the time of the outbreak of the Revolutionary War, 1821-29, the islanders were considered the richest in the archipelago. They possessed the carrying trade of the Black Sea, and shipped to England, the Baltic, and even to America. Since the Revolution, however, more accessible ports have risen to be the centres of Greek commerce, and Hydra has greatly declined. The population, in 1896, was 7177, almost all concentrated in the town of Hydra.

HYDRA (Lat., from Gk. *῞Υδρα*). A fabulous monster, offspring of Typhon and Echidna, dwelling on a hill near the spring Amymone in the marshes of Lerna near Argos. The hydra had many heads, of which the central one was immortal. The number of heads varies from 9 to 50, or even 100. In works of art she is shown with from 3 to 12 heads, except in Hellenistic times, when the hydra is often represented as a serpent with a woman's head. Hercules cut off the heads, while his companion, Iolaus, seared the stumps with a brand, as otherwise two heads grew wherever one was cut off. The immortal head was buried beneath a huge rock. The hero dipped his arrows in the blood and thereby made the wounds which they inflicted incurable. The hydra with its poisonous breath seems a personification of the malarial vapors arising from the swamps of Lerna.

HYDRA (Lat., from Gk. *ὕδρα*, water-snake. Skt., Lith. *udra*, OChurch Slav. *vydra*, OHG. *ottar*, Ger. *Otter*, Eng. *otter*, with Gk. *ὕδωρ*, *hydōr*, water). A minute polyp or hydrozoan, common in still, fresh waters. It possesses a gelatinous, subcylindrical body, which, from its contractility, undergoes various alterations of form. One end expands into a disk or foot, which adheres to a leaf or twig; while a mouth surrounded by a circlet of tentacles, varying from five to twelve or more in number, is at the opposite end. These tentacles are exceedingly contractile; at one moment they are thrown out as long, delicate threads, at the next, drawn up into minute wart-like knobs. Numerous thread-cells project from their surface, the larger ones possessing a sheath and three recurved darts or barbs, and terminating in a large and extremely slender filament. The mouth leads into a capacious cavity, excavated throughout the entire length of the animal, which, exclusive of its tentacles, seldom exceeds three-fourths of an inch. The food of the hydra consists of such minute living organisms as come within the reach of its tentacles, and by these apparently fragile threads, which the animal projects like a lasso, crustaceans, worms and the like are seized, which would be deemed at first sight superior to their captor in strength and activity. The tentacles, however, exert through the action of the thread-cells a powerful benumbing or paralyzing influence. The prey when mastered, but often when still alive, is thrust into the internal cavity, where the nutritive parts are absorbed by the hydra, while the indigestible parts are expelled through the mouth.



HYDRA VIRIDIS.
t, tentacles; *q*, a bud; *a*, young hydra, developed from a bud.

Although the hydra is usually found adhering to submerged supports, it is not permanently fixed. It often moves on surfaces under water somewhat after the manner of a leech, and occasionally the disk is protruded above the water, and thus acts as a float. Sometimes, especially in the autumn, true reproductive organs may be observed, both male and female organs being usually situated on the same animal. Propagation by gemmation is, however, the most common mode of increase. Minute tubercles appear on the body of the parent animal, which, as they increase in size, gradually become perforated at their free extremity, and acquire tentacles. The pedicel by which they originate by degrees becomes thinner, and finally gives way, leaving the young hydra perfectly independent. One of the most remarkable points in the history of this animal is its power of being multiplied by mechanical division. If a hydra be cut into two or even more pieces, every one will in time assume the form and functions of the original animal. Several species of hydra have been described, which differ in size, color, and other respects. Two species are common in America, in still water in nearly all parts of the country. One of these (*Hydra viridis*) is bright green in color, while the other (*Hydra fusca*) is grayish-brown. The green hydra is notable because its color is due to the presence of chlorophyll, the coloring matter characteristic of plants. Both may easily be reared in aquariums.

HY′DRAGOGUES (from Lat. *hydragogus*, Gk. *ὑδραγωγός*, water-carrier, from *ὕδωρ*, *hydōr*, water + *ἀγωγός*, *agōgos*, carrying, from *ἄγειν*, *agein*, to lead). Active purgatives which give rise to large, watery stools. The most important are colocynth, elaterium, gamboge, jalap, croton oil, and scammony. These are all powerful drugs, and their administration requires skilled advice.

HYDRANGEA, hī-drăn′jė-ȧ (Neo-Lat., from Gk. *ὕδωρ*, *hydōr*, water + *ἀγγεῖον*, *angeion*, pail). A genus of about 25 species of ornamental deciduous shrubs of the natural order Saxifragaceæ, natives of North and South America, China, and Japan. The flowers are white, pink, or bluish, and small, but are borne in large, showy corymbs or panicles, the exterior flowers of which are sterile. The pink varieties, when grown on some soils, produce bluish flowers. The hardier cultivated hydrangeas are *Hydrangea paniculata*, used as specimens or in borders, *Hydrangea arborescens*, and *Hydrangea radiata*. *Hydrangea Hortensia*, or *Otaska*, is a rather dwarf variety, which is extensively grown in greenhouses, especially for the Easter trade. Hydrangeas require a rather heavy, rich soil, well manured and well watered. They are propagated for the most part by cuttings and division, but sometimes by seed.

HYDRANGEA.

HYDRAS′TIS (Neo-Lat., from Gk. *ὕδωρ*, *hydōr*, water + *δρᾶν*, *dran*, to act), or Warneria. A genus of plants of the natural order Ranunculaceæ, allied to Anemone, the members of which have flowers destitute of petals, and succulent or baccate fruit, collected into a head. The only known species, *Hydrastis Canadensis*, a perennial herbaceous plant, with tuberous roots, and head of fruit resembling a raspberry, is common in watery places in Canada, and among the Alleghanies as far south as the Carolinas. Its root is used for dyeing yellow, and also in medicine as a tonic. Yellowroot, orangeroot, and goldenseal are its American names.

HY′DRATE (from Gk. *ὕδωρ*, *hydōr*, water). A name applied to substances whose molecules contain either one or more entire molecules of water; or, synonymously with the term hydroxide, to metallic compounds whose molecules contain one or more hydroxyl groups (OH). Thus, for example, the question has been discussed, whether substances exist in aqueous solution in the form of 'hydrates,' or not; that is to say, whether the dissolved molecules are associated into definite groups with those of the solvent. In the same sense a substance containing water of crystallization is sometimes spoken of as a hydrate, and its crystals as 'hydrated crystals,' particularly when they are to be distinguished from the 'anhydrous crystals' of the same substance. On the other hand, chemists often use such terms as potassium hydrate, or calcium hydrate, in the same sense as they use the terms potassium hydroxide and calcium hydroxide. The hydrates, or hydroxides, of the metals are true chemical compounds. The assumption that substances are *chemically* combined with their water of crystallization, while corroborated by many facts, has not yet been brought into harmony with the doctrine of valency (q.v.), and cannot therefore be granted unconditionally.

HYDRAULIC CEMENT. See Cement.

HYDRAULIC ELEVATORS. See Elevators.

HYDRAULIC ENGINE. See Hydraulic Pressure Engine.

HYDRAULIC FORGING. See Forge, Forging.

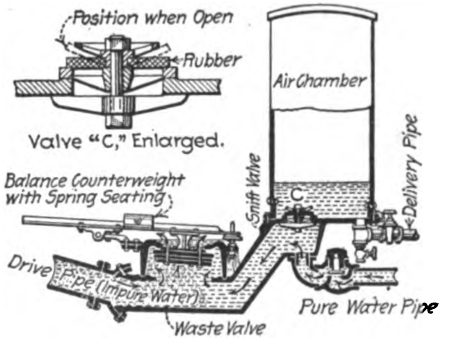
HYDRAULIC JACK. See Jack.

HYDRAULIC PRESS (from Lat. *hydraulicus*, Gk. *ὑδραυλικός*, *hydraulikos*, pertaining to the water-organ, from *ὕδραυλις*, *hydraulis*, water-organ, from *ὕδωρ*, *hydōr*, water + *αὐλός*, *aulos*, pipe). An apparatus for obtaining a heavy pressure for compacting fibrous substances, raising heavy weights, etc., by means of water under pressure. The first design of a working hydraulic press is credited to Joseph Bramah, and for this reason such machines are sometimes called Bramah presses. The operation of the hydraulic press is based upon the principle of hydrostatics that a pressure exerted on any part of the surface of a liquid is transmitted undiminished to all parts of the mass and in all directions. Thus, if we have a cylinder filled with water in one end of which works a plunger one inch square, and in the other end of which works a plunger twelve inches square, and we exert a pressure of one pound on the smaller plunger, this pressure will be transmitted undiminished by the water, and will exert a total pressure of 1 × 12 × 12=144 pounds.

The essentials of a hydraulic press are, therefore, a small cylinder containing a plunger, to which pressure is applied, connected by pipe with a large cylinder containing a plunger, which transmits the multiplied pressure to the object to be pressed or lifted. It is evident, furthermore, that the two cylinders may be located any desired distance apart, the only limit being that at which the pipe and cylinder friction reduces the available pressure for performing work below practicable amounts. (See POWER, TRANSMISSION OF.) In modern practice the pressure pump commonly feeds into a hydraulic accumulator (see ACCUMULATOR), and the press cylinder is operated from the accumulator and not directly from the pump. The construction of hydraulic presses varies with the purposes for which they are employed. Hydraulic presses for baling hay and cotton and expressing the oil from seeds, etc., are built substantially as follows: Four iron pillars are erected at the corners of a horizontal square, and carry a cast-iron cap rigidly fastened to their tops. The under face of this cap forms the surface against which the material is pressed. At the bottom of the four pillars there is a similar casting which has a circular hole in the centre down through which passes the cylinder casting for the plunger. The plunger has an upward motion in the act of pressing, and carries on its top a head or platen consisting of a square casting. The material to be pressed is placed between the lower face of the top casting and the upper face of the platen. Often a boxing is placed around the four sides of the space in which the head moves to prevent the material being pressed from squeezing out laterally. The construction of a press for hydraulic forging differs from the above as follows: The cylinders and plungers are carried by the top casting or column cap and the plungers work downward in the act of pressing; the bottom casting carries the anvil; the plungers carry a die for the head; and two or more cylinders are provided for raising the plunger and die for a fresh stroke. Generally, also, two pressure plungers and cylinders are employed instead of one. Forging presses are made of all sizes, from that required in pressing out articles like revolver cartridge cases to those used in forging steamship shafts and armor plates. Armor-plate presses having a capacity of 14,000 tons are in use.

HYDRAULIC PRESSURE ENGINE. A motor in which water is made to do work by means of its pressure only acting on a piston or plunger reciprocating in a cylinder, or, in some cases, on a revolving piston similar to those employed in a rotary steam-engine. In the case of a turbine the pressure of a column of water is, in the first instance, employed in giving motion to the fluid itself, and after this motion has been produced the energy due to it is utilized in doing work. In the case of the pressure engine the only pressure expended in giving motion to the fluid is that needed to make the water follow the piston and escape from the motor, and to secure efficiency this piston should be as small as practicable. This end is most nearly secured when the pressure is great and the speed of the engine is low. The first pressure engine was designed by Sir William Armstrong (q.v.), and was of the rotary type. This engine was never actually used, and was replaced by a reciprocating engine designed by the same engineer. Since Sir William Armstrong's invention a great variety of hydraulic pressure engines have been invented, the majority of which are of the reciprocating type. Hydraulic pressure engines are particularly adapted to the use of high-pressure water in comparatively small quantities, and where these conditions prevail they have a considerable field of usefulness, particularly as secondary motors for operating mechanical contrivances, such as the opening machinery for swing bridges, cranes, hoists, etc. For further information consult Bodmer, *Hydraulic Motors, Turbines, and Pressure Engines* (New York, 1889). See TURBINE.

HYDRAULIC RAM. Primarily, a device by which the momentum of water flowing by gravity in a pipe is utilized to lift a portion of itself through another pipe to an elevation greater than the source of supply. The flow of water in the main or drive pipe is automatically checked by the closing of a valve at its foot. When the valve is open the water escapes freely and flows to waste, but very soon a sufficient momentum is attained to close the valve. The confined water then lifts another valve, opening into an air-chamber mounted over the foot of the drive-pipe. The water partially fills this chamber, and in so doing compresses the air therein until the pressure in the chamber just balances that of the column of water in the drive-pipe. The valve at the foot of the drive-pipe then opens, and the process is repeated. The pressure of the compressed air in the air-chamber forces the water in the bottom of the chamber out through a small supply pipe to the desired elevation. A snifting valve is provided to supply air to the chambers to make good the losses due to absorption of air by the water. Theoretically, 100 gallons of water falling 15 feet would raise 15 gallons 100 feet, and other quantities and heights in like proportion; but some water is wasted during each cycle, and there is more or less friction to be overcome, depending on the design of the ram and the length and diameter of the pipes. An efficiency of 75 per cent. would be high. With the increase in the ratio of the fall of the driving water to the elevation to be overcome, the efficiency decreases, particularly



RIFE HYDRAULIC RAM.

when the ratio exceeds 1·12 (i.e. 1 foot fall for 25 feet raised). Where the fall is great, the wear and tear on the ram is excessive. Some authorities give the desirable working limit for a hydraulic ram as 1½ to 10 feet fall of drive water and a lift of not over 250 feet, but with so great a lift a large proportion of the water will be wasted. The ram, as described, was invented by Joseph Michael de Montgolfier, of France, in 1796; but in 1772 an Englishman named John Whitehurst built a machine embodying the same principle, except that the valve at the foot of the drive-pipe had to be closed by hand. His device was described in the *Philosophical Transactions* for 1775. Many improvements have been made in the machine of Montgolfier, the most important of which, perhaps, aim to lessen the shock of the operation of the valves. Springs have been used to that end; the drive-pipe valve has been counterweighted, and a portion of the air compressed in the chamber has been used to drive a small air-motor, so connected as to aid in the gentle closing of the valve at each cycle. Another improvement is the equipment of rams so that a supply of dirty water may be used to lift clean water, either when the supply of the latter is scanty, or is not available under a sufficient head. Finally, hydraulic rams are used to drive pumps, when they are properly classed under pumping engines. See PUMPS AND PUMPING MACHINERY.

HYDRAULICS. See HYDRODYNAMICS, and HYDROSTATICS.

HY'DRAZINE, or AMIDOGEN, $H_2N = H_2$. A basic compound of nitrogen and hydrogen, which may be obtained by heating triazo-acetic acid with water. Hydrazine hydrate, $N_2H_4H_2O$, is a strong reducing agent precipitating metallic silver and platinum from solutions of their salts. With acids it forms crystalline salts, such as the hydrochlorides, $N_2H_4.Hcl$, and N_2H_42HCl, the sulphate, $N_2H_4.H_2SO_4$, etc. The hydrogen of hydrazine may be partly replaced by either hydrocarbon groups, such as methyl (CH_3), ethyl (C_2H_5), phenyl (C_6H_5), etc., or organic acid radicals, such as acetyl (CH_3CO), benzoyl (C_6H_5CO), etc. The most important of these organic derivatives of hydrazine is phenyl hydrazine, $C_6H_5HN = NH_2$. The benzoyl compounds include benzoyl-hydrazine, $C_6H_5CO.HN = NH_2$, and symmetrical dibenzoyl-hydrazine, $C_6H_5CO.HN = NH.COC_6H_3$. The presence of hydrazine in aqueous solutions may be readily detected by the use of a few drops of benzaldehyde, with which it forms a yellow crystalline precipitate of benzalazine, $C_6H_6CH.N = NH_2$. Compounds of similar constitution are formed by the action of hydrazine on other aldehydes. See DIAZO-COMPOUNDS.

HY'DRIDE. A name applied, in chemistry, to the compounds of the metals with hydrogen. Notable hydrides are those of palladium, sodium, potassium, calcium, strontium, barium, and magnesium. The hydrides have, at least as yet, no practical value; but when more thoroughly investigated they will present considerable interest in connection with the doctrine of valency (q.v). The term hydride was formerly employed in connection with certain hydrocarbons.

HY'DRIOD'IC ACID (from *hydr*-ogen + *iod*-ine), HI. An acid compound of hydrogen and iodine, analogous to hydrochloric acid. It may be prepared by the action of phosphoric acid on potassium iodide. In its isolated state, it is a colorless gas with an odor resembling that of hydrochloric acid. Usually it is kept in aqueous solution, and is thus employed in a number of chemical processes. It decomposes somewhat easily into its components, hydrogen and iodine, and by giving up its hydrogen acts as a reducing agent. The salts of hydriodic acid are termed *iodides* (q.v.). Hydriodic acid is sometimes used medicinally instead of its salts.

HY'DRIOTAPH'IA, or **URN BURIAL.** A quasi-scientific, quasi-religious treatise by Sir Thomas Browne (1658). Its explanatory subtitle is: *A Discourse of the Sepulchral Urns Lately Found in Norfolk*, which leads to the account of the rites of burial of various ages, and ends with an eloquent disquisition on death and immortality. It shows an acquaintance with Dante remarkable for that age, and was greatly admired by Charles Lamb.

HY'DROBRO'MIC ACID (from *hydro*-gen + *brom*-ine), HBr. An acid compound of hydrogen and bromine, analogous to hydrochloric acid. It may be prepared by the action of phosphoric acid upon potassium bromide. In the isolated state it is a colorless gas with an odor resembling that of hydrochloric acid. Like the latter, it is very soluble in water, the solution being sometimes used in synthetic chemistry. The salts of hydrobromic acid are termed *bromides* (q.v.).

HY'DROCAR'BONS (from *hydro*-gen + *carbon*). A class of chemical compounds containing only carbon and hydrogen. Their commercial value is very considerable inasmuch as they form the principal ingredients of petroleum, illuminating gas, caoutchouc, gutta-percha, essence of turpentine, etc. They are the simplest of the compounds of carbon, and the fundamental ideas of organic chemistry have been derived largely from a careful study of their properties and reactions. They are obtained when various organic substances are subjected to a process of destructive distillation, and are subdivided principally into *aliphatic*, or fatty, and *aromatic* hydrocarbons.

FATTY HYDROCARBONS. These form an important class, and are subdivided into the paraffin, olefin, and acetylene series.

(1) *The Paraffins*, or saturated hydrocarbons of the methane series, are very stable compounds and do not react even with the strongest acids and alkalies; hence their name, paraffins, derived from the Latin *parum affinis*, which means 'having little affinity.' Large quantities of them occur in nature as petroleum, natural gas, ozokerite, etc. They are also obtained by the destructive distillation of coal, cannel, shale, etc. When they are arranged in the order of their molecular weights, the following 'homologous series' is obtained:

Methane,	CH_4,	molecular weight 16.
Ethane,	C_2H_6,	molecular weight 80.
Propane,	C_3H_8,	molecular weight 44.
Butanes,	C_4H_{10},	molecular weight 58.
Pentanes,	C_5H_{12},	molecular weight 72.
Hexanes,	C_6H_{14},	molecular weight 86.
Heptanes,	C_7H_{16},	molecular weight 100, etc.

The difference in molecular weight between any two consecutive members of the series is evidently the same. It amounts to 14. the sum of the 'weights' of one carbon atom (which is 12) and two hydrogen atoms (which is 2). To obtain the formula of any member, we may substitute a methyl group, CH_3, in place of a hydrogen atom in the member immediately preceding it. Thus, by substituting CH_3 in place of one H in ethane, C_2H_6, we get propane, $C_2H_5CH_3$ or C_3H_8. The transformation of ethane into propane may be actually effected as follows: First, mono-iodo-ethane (C_2H_5I) is obtained by substituting one iodine atom in lieu of one atom of hydrogen in ethane (C_2H_6); then mono-iodo-ethane is treated with methyl iodide (CH_3I) and metallic sodium. The iodine is thus all removed, and the remaining C_2H_5 group unites with CH_3 group to form the compound propane ($C_2H_5CH_3$ or C_3H_8).

The first four members of the above homologous series are liquefiable gases, and each member is more easily liquefied than the one preceding it; the next eleven members are liquids, each having a higher *boiling-point* than the one preceding it; finally, the higher members are solids, each having a higher *melting-point* than the one preceding it. The lower members burn with a pale, scarcely luminous flame; the higher members give a bright light, and paraffin wax, which is a mixture of solid paraffin hydrocarbons, is used for the manufacture of candles. The paraffins are all colorless, chemically inert, and insoluble in water.

The composition of any single paraffin hydrocarbon is expressed, of course, by its own molecular formula. Thus, the formula C_2H_6 shows the chemical composition of ethane; the formula C_3H_8 shows the composition of propane, etc. On the other hand, the composition of the paraffin hydrocarbons in general is expressed by a *typical formula*, in which algebraic symbols stand for the numbers of atoms of the component elements. This typical (general) formula is, $C_n H_{2n+2}$. The formula permits readily to calculate the number of hydrogen atoms in any one of the members of the above homologous series, if the number of its carbon atoms is given. Thus, if $n = 1$, then $2n + 2 = 4$, and $C_n H_{2n+2}$ becomes CH_4 (the formula of methane). The highest member of the series that is actually known to chemists contains 60 carbon atoms, and hence, the typical formula tells us, the number of hydrogen atoms in the molecule of that hydrocarbon (called *hexacontane*) is $2n + 2 = 2 \times 60 + 2 = 122$, and its molecular formula is therefore $C_{60}H_{122}$. It is a well-known fact that compounds exist which have the same chemical composition and yet differ in their physical and chemical properties. Such compounds are termed 'isomeric,' and their mutual relations are explained on the assumption that the atoms in their molecules, though the same in kind and number, are differently *grouped*. In the above homologous series, the first three members have no such isomers, i.e. only one variety of each could be obtained; the fourth member, butane, has two isomers (called butane and isobutane); the fifth member, pentane, has three isomers; the sixth, hexane, has five isomers, etc. The higher the molecular weight, the greater the number of isomeric formulas which could be constructed according to the structural theory. Not all of these theoretically possible hydrocarbons have been actually prepared in the laboratory. Most of them have no practical value and are interesting only inasmuch as they go to prove the validity of the 'structural theory' of compounds; but the number of cases of isomerism in which the theory has been found to hold true is so great that chemists are no longer anxious to obtain new proofs by artificially producing all of the possible isomeric compounds. See CARBON COMPOUNDS.

(2) *The Olefins*, or hydrocarbons of the ethylene series, have the characteristic property of directly taking on bromine and other elements to form *additive* products. This shows that the combining capacity of the carbon contained in them is not completely satisfied by their hydrogen; so they are said to be 'unsaturated compounds.'

When arranged in order of their molecular weights, they form the following homologous series:

Ethylene, C_2H_4, molecular weight 28.
Propylene, C_3H_6, molecular weight 42.
Butylenes, C_4H_8, molecular weight 56.
Amylenes, C_5H_{10}, molecular weight 70.
Hexylenes, C_6H_{12}, molecular weight 84, etc.

In this series, too, each member contains one carbon and two hydrogen atoms more than the member immediately preceding it; that is to say, the difference in molecular weight between any two consecutive members of the series amounts to 14. Here, too, as in the paraffin series, a certain amount of regularity is found in the variation of the physical properties of the compounds on passing up the series. The first four members are gases, and each one is more easily liquefied than the one preceding it. Hexylene and the following 13 members are liquids, each one boiling at a higher temperature than the one preceding it. The higher members are solids, and each one has a higher melting temperature than the one preceding it. The olefins are colorless and insoluble in water. They contain a high percentage of carbon and burn with a luminous flame.

The composition of *all* the olefins is expressed by the typical formula of the series, $C_n H_{2n}$. The ratio of the numbers of hydrogen and carbon atoms is the same throughout the series; showing that the different members of the series have all the same percentage composition. They are, however, not isomeric, in the ordinary sense of the term: for their molecules evidently contain different numbers of atoms. Thus ethylene (C_2H_4) contains two carbons and four hydrogens; propylene (C_3H_6), three carbons and six hydrogens, etc. But, beginning with butylene, each single member represents several compounds which must be considered as isomeric, since they have precisely the same molecular composition and yet differ in their properties. The structural theory lets us foresee the existence of three isomeric butylenes, five amylenes, thirteen hexylenes, etc. Again, as in the paraffin series, the higher the molecular weight, the greater the number of isomers possible, according to both theory and experience.

Nascent hydrogen adds itself readily to the olefins (unsaturated), yielding hydrocarbons of the paraffin series (saturated).

(3) *The Acetylene Hydrocarbons*, when arranged in the order of their molecular weights, form the following homologous series:

Acetylene, C_2H_2, molecular weight 20.
Allylene, C_3H_4, molecular weight 40.
Crotonylene, C_4H_6, molecular weight 54, etc.

Like any other homologous series, the acetylene series presents a certain amount of regularity in the variation of the physical properties of the compounds with increase of their molecular weight.

The acetylenes are unsaturated; in fact, 'doubly unsaturated' compounds (see ACETYLENE), as is shown by their capacity for taking on bromine and other elements to form additive products. The acetylene hydrocarbons burn with a very smoky flame, unless by some method enough oxygen is supplied to burn up completely the large amount of carbon they contain. The general formula of the series is C_nH_{2n-2}. Nascent hydrogen adds itself readily to the acetylene hydrocarbons, yielding still unsaturated hydrocarbons of the ethylene series.

AROMATIC HYDROCARBONS. The principal groups into which these hydrocarbons are subdivided include the *Benzene series*, the *Naphthalene series*, and the *Anthracene series*. The typical formulas representing these three series are, respectively, C_nH_{2n-6}, C_nH_{2n-12}, and C_nH_{2n-18}. Other hydrocarbons, not included in these series, are represented by the formulas C_nH_{2n-8}, C_nH_{2n-16}, C_nH_{2n-22}, etc.; but these are not important enough to be mentioned here. The most important members of the benzene series are benzene (C_6H_6), toluene (C_7H_8), and xylene (C_8H_{10}). The most important substance of the naphthalene series is naphthalene itself ($C_{10}H_8$); that of the anthracene series, anthracene ($C_{14}H_{10}$). All these are described in special articles. Suffice it to mention here that the chief source of aromatic hydrocarbons is the coal-tar (q.v.) obtained as a by-product in the manufacture of coal-gas, and that it is principally from these hydrocarbons that innumerable artificial dyestuffs, drugs, etc., are now made on a very large industrial scale. See also CARBON COMPOUNDS.

The hydrocarbons should not be confounded with the 'carbohydrates,' like sugar, starch, or cellulose, which contain besides carbon and hydrogen also oxygen.

HY'DROCELE (Lat., from Gk. *ὑδρωκήλη*, *hydrōkēlē*, from *ὕδωρ*, *hydōr*, water + *κήλη*, *kēlē*, tumor). The medical term for dropsy of the tunica vaginalis, a serous membrane or sac investing the testes. Hydrocele occurs as a smooth, pear-shaped swelling, fluctuating when pressed, devoid of pain or tenderness, but sometimes causing a slight uneasiness from its weight. The quantity of serous fluid in the sac is usually from 6 to 20 ounces, but it occasionally exceeds 100 ounces. Hydrocele may occur as a result of acute inflammation, but it most commonly comes on without any apparent local cause. It is most frequently met with about or beyond the middle period of life, and generally in persons of feeble power, or with a tendency to gout; sometimes, however, it occurs in young children, either in the same form as in adults, or as what is termed *congenital hydrocele*, when the communication between the tunica vaginalis and the abdominal peritoneum is not obliterated, as it normally should be. Palliative treatment consists in the use of suspensory bandages, strapping, and tapping with a fine trochar. Tapping seldom gives more than temporary relief, the swelling usually regaining its former bulk in three or four months. A cure is sometimes effected after tapping by the injecting of irritating substances, such as tincture of iodine and carbolic acid. The only certain method of cure, however, consists in excision of the tunica vaginalis.

HY'DROCEPH'ALUS (Neo-Lat., from Gk. *ὑδροκέφαλον*, *hydrokephalon*, water in the head, from *ὕδωρ*, *hydōr*, water + *κεφαλή*, *kephalē*, head). A collection of serous fluid in the cranium. If it is within the ventricles of the brain, the condition is known as *internal hydrocephalus*. If beneath the arachnoid membrane, *external hydrocephalus*. The disease may be *primary*, being then usually tuberculous in origin, or it may follow some other disease, in which case it is termed *secondary*. Three types, the *acute*, the *chronic*, and the *congenital*, are described. Hydrocephalus may occur in children or in adults as a secondary lesion resulting from meningitis. In such cases, the bones of the skull having united, there is much less opportunity for distention.

ACUTE HYDROCEPHALUS. This is usually a sudden disease, marked by an acute collection of fluid within the skull, internal or external to the brain ventricles. It may be primary or secondary to such diseases as whooping cough, heart disease, rachitis, tumors within the skull-cavity, or acute fevers, such as pneumonia or typhoid. The symptoms are various, much depending on its cause. The most characteristic symptoms are those due to the pressure on the brain. In addition to the enlargement of the head, there may be much restlessness, inability to sleep, nausea and vomiting, paralysis or convulsions. The pupils are apt to be unequal and sluggish. In the severer cases pressure upon the brain causes death.

CHRONIC HYDROCEPHALUS. This may follow an acute attack, or the disease may begin very insidiously. The symptoms again are those due to pressure. The fontanelles in the skull are apt to bulge, the eyeballs protrude somewhat, the blood-vessels on the outside of the head are apt to be swollen and prominent. Headache is common. A peculiar sidewise shifting movement of the eye, termed nystagmus, is very constant, and crossed eyes are not uncommon. There is usually much restlessness, and if the patients live they are apt to be dull mentally or idiotic. Some of these patients live to middle age, but most of them die young. The treatment requires the greatest medical and surgical skill.

CONGENITAL HYDROCEPHALUS. The distention may be so slight at birth as to be scarcely evident, or the distention may be considerable, or so advanced as to preclude the birth of a living child. After birth the progress of the disease may be gradual or rapid. The lateral ventricles usually show the greatest distention, although all the ventricles may be involved as well as the central canal of the cord. The condition of the brain-tissue depends entirely upon the amount of pressure. It may be little different from normal, or the convolutions may be flattened, or the hemispheres may be reduced to a thin layer under the dura mater. The brain-tissue itself is apt to be soft and flabby, and the base of the brain is usually less affected than the hemispheres. The openings between the bones of the skull are large in size, the bones thin, and tending to bulge forward, making the forehead prominent.

HYDROCHARIDEÆ, hī'drō-kă-rĭd'ē-ē, or **HY'DROCHAR'IDA'CEÆ**. An order of aquatic plants. See VALLISNERIA.

HY'DROCHLO'RIC ACID (from *hydro*-gen + *chlor*-ine), or MURIATIC ACID, HCl. A gaseous compound of hydrogen and chlorine, the aqueous solution of which is extensively used in the arts. It was known to the alchemists, who refer to it as *spiritus salis;* Glauber prepared it by treating common salt with sulphuric acid. Priestley obtained it similarly and called it *marine acid air.* Lavoisier introduced the view that all acids necessarily contain oxygen, and hence hydrochloric acid was for years believed to contain oxygen. About 1810 Sir Humphry Davy had established the elementary nature of chlorine, and hence the true nature of its hydrogen compound—hydrochloric acid; and within ten years the correctness of his results became generally recognized. (See CHEMISTRY.) Hydrochloric acid occurs in the exhalations from active volcanoes, especially from Vesuvius and the fumaroles of Hecla. It is also a constituent of the waters of certain South American rivers that have their source in the volcanic districts of the Andes. Also it is a constituent of the gastric juices in man and animals, and plays an important part in the digestive process. When sodium chloride (common salt) is decomposed by heating with sulphuric acid, as in the Le Blanc process for making soda, sodium sulphate (Glauber's salt) remains behind, while gaseous hydrochloric acid is evolved. The acid was formerly allowed to pass off into the air, and naturally had a very injurious effect on the vegetation in the vicinity of the manufacturing establishments. At present the acid vapors are carefully collected, and thus hydrochloric acid constitutes an important by-product of the manufacture of soda.

Hydrochloric acid is a colorless gas, with a pungent odor and taste, and fuming strongly in the air. On the application of pressure and cold it can be condensed to a colorless liquid; but the commercial product is usually dissolved in water. The commercial acid is generally colored by the presence of some iron; it also usually contains arsenic and sulphuric acid, from all of which impurities it may be freed by distillation. The acid is used in preparing the chlorides of various metals, for extracting phosphates from bones, in dyeing and tissue printing, and in the manufacture of coal-tar colors. For works on hydrochloric acid, consult the various books on the manufacture of soda ash.

CHLORIDES. The salts of hydrochloric acid are termed chlorides. By far the most important of these is the chloride of sodium or common salt, which is described in a special article. Very similar to it is the chloride of potassium, KCl, which occurs extensively (combined with magnesium chloride) in the mineral carnallite, and in smaller quantities in sea-water. It is manufactured from carnallite, and is purified by recrystallization from water. The chloride of aluminum, Al_2Cl_6, is obtained by treating aluminum oxide with charcoal in a current of chlorine. It is readily soluble in water, alcohol, and ether, but on evaporating its aqueous solution it combines with water to form aluminum hydroxide and free hydrochloric acid. Aluminum chloride is largely used in organic chemistry in the so-called Friedel and Crafts reaction. (See FRIEDEL.) For other chlorides, see BARIUM; CALOMEL; GOLD; MANGANESE; MERCURIC CHLORIDE; and SAL AMMONIAC. See also BLEACHING-POWDER.

HY'DROCOR'ALLI'NA (Neo-Lat., from Lat. *hydra*, water-snake + *corallinus*, coral-red, from *coralium*, coral). An order of Hydromedusæ, including the important Paleozoic family Stromatoporidæ. See CŒLENTERATA; HYDROZOA.

HY'DROCYAN'IC ACID (from *hydro*-gen + *cyan*-ogen), HCN, or HCy. A chemical compound often called *prussic acid,* from its having been first obtained by Scheele in 1782 from the substance known as Prussian or Berlin blue. Hydrocyanic acid is of equal interest to the chemist, the physician, and the toxicologist. The pure anhydrous acid is a limpid volatile liquid of a strong, penetrating odor resembling that of peach-blossoms or oil of bitter almonds. At low temperatures it solidifies to a crystalline mass that melts at —15° C.; at 18° C. it has a specific gravity of 0.697, and it boils at 26° C. (78.8° F.). Its volatility is so great that if a drop be allowed to fall on a piece of glass, part of the acid becomes frozen through the cold produced by its own evaporation. It burns with a pale-blue flame, reddens litmus paper slightly (its acid properties being feeble), and is very soluble in water and in alcohol. In the anhydrous state it is not affected either by the action of air or by that of light. In the presence of moisture, however, it is decomposed with formation of a brown substance known as azulmic acid. If its aqueous solution is exposed to light, decomposition rapidly takes place, with formation of a number of different substances, including ammonia, formic and oxalic acids, etc.

Hydrocyanic acid is made by heating yellow prussiate of potash (potassium ferrocyanide) with dilute sulphuric acid, the reaction taking place according to the following chemical equation:

$$\underset{\substack{\text{Potassium}\\ \text{ferrocyanide}}}{2K_4Fe(CN)_6} + \underset{\substack{\text{Sulphuric}\\ \text{acid}}}{3H_2SO_4} =$$

$$\underset{\substack{\text{Hydrocyanic}\\ \text{acid}}}{6HCN} + \underset{\substack{\text{Potassium-iron}\\ \text{ferrocyanide}}}{FeK_2Fe(CN)_6} + \underset{\substack{\text{Potassium}\\ \text{sulphate}}}{3K_2SO_4}$$

In this manner a more or less dilute solution of hydrocyanic acid is obtained, and by fractional distillation and drying over calcium chloride, the anhydrous acid may be prepared. An aqueous solution of hydrocyanic acid may also be obtained by shaking silver cyanide with dilute hydrochloric acid. Hydrocyanic acid occurs, both free and in combination, in various plants, and it is readily produced by macerating bitter almonds or cherry kernels with water. Bitter almonds, as well as many other vegetable products, contain a glucoside called *amygdalin,* and a peculiar ferment called *emulsin.* When brought into contact with water, the amygdalin is acted on by the emulsin, hydrocyanic acid being formed along with other substances, according to the following equation:

$$\underset{\text{Amygdalin}}{C_2H_{27}NO_{11}} + 2H_2O = \underset{\substack{\text{Hydrocyanic}\\ \text{acid}}}{HCN} + \underset{\substack{\text{Benzal-}\\ \text{dehyde}}}{C_7H_6O} + \underset{\text{Glucose}}{2C_6H_{12}O_6}$$

The dilute acid of the U. S. Pharmacopœia contains 2 per cent. by weight of anhydrous hydrocyanic acid; while what is known as "Scheele's Prussic Acid" contains from 4 to 5 per cent. of the absolute acid. The presence of hydrocyanic acid in solutions may be best proved by one of the following methods:

(1) To the solution in which the presence of hydrocyanic acid is suspected, caustic potash is added to strongly alkaline reaction, then a few drops of ferrous sulphate are added, and heat is

applied; the solution is now acidified with hydrochloric acid, and some ferric chloride is added. If hydrocyanic acid was present in the original solution, a precipitate of Prussian blue, or at least a blue coloration, is produced.

(2) A few drops of ammonium sulphide are added to the suspected liquid, and the mixture is evaporated on the water-bath; the dry residue is moistened with ferric chloride, when, if hydrocyanic acid was present in the original solution, an intense red coloration is produced.

The quantity of hydrocyanic acid in a solution may be determined by adding to the latter a solution of silver nitrate, separating the precipitated cyanide of silver by filtration, washing, drying, and weighing. The amount of hydrocyanic acid may be readily calculated from the weight of silver cyanide found. We are indebted to the Italians for the introduction of hydrocyanic acid in the materia medica. There are no cases in which it is so serviceable as in those affections of the stomach in which pain is a leading symptom, as in gastrodynia, water-brash, and in cases of intense vomiting. It is also useful in allaying spasmodic cough, and has been employed with advantage in chronic skin-diseases, to allay pain and irritation, no matter what the cause. A mixture of one part of the dilute acid (of 2 per cent. strength) with about 48 parts of water forms a good lotion.

Hydrocyanic acid is one of the most energetic poisons, and is frequently employed both in murder and suicide. A single drop of the pure acid causes instant death if placed inside the eye. When a small poisonous dose (about half a dram of the 2 per cent. acid) has been taken, the first symptoms are weight and pain in the head, with confusion of thought, giddiness, nausea (and sometimes vomiting), a quick pulse, and loss of muscular power. If death result, this is preceded by tetanic spasms and involuntary evacuations. When a large dose has been taken (as from half an ounce to an ounce of the 2 per cent. acid), the symptoms may commence instantaneously, and it is seldom that their appearance is delayed beyond one or two minutes. The patient is insensible; his eyes are fixed, the pupils are dilated and unaffected by light; the limbs are flaccid, and the skin is cold and clammy; the respiration is slow and convulsive, and the pulse is imperceptible.

Hydrocyanic acid causes paralysis of the heart, of the respiratory centre, and of the vaso-motor centre in the medulla. The spinal cord, too, is paralyzed shortly before death. The immediate cause of death is, in most cases, obstruction of the respiration; but in some cases it lies in stoppage of the heart's action.

Where the fatal action is so rapid antidotes are of comparatively little value. Chlorine, ammonia, peroxide of hydrogen, cold affusion, and artificial respiration are the most important agents in the treatment. Cold affusion on the head, neck, and down the spine is a valuable remedy, and it is asserted that its efficacy is almost certain when it is employed before the convulsive stage of poisoning is over, and that it is often successful even in the stages of insensibility and paralysis. One-fiftieth grain of atropine should be injected subcutaneously. Artificial respiration should never be omitted.

Among the compounds of hydrocyanic acid may be mentioned the cyanides of potassium and mercury. The more important ferrocyanides and ferricyanides are described in the articles on hydro-ferrocyanic and hydro-ferricyanic acids (qq.v.).

Potassium cyanide is an extremely poisonous white crystalline substance soluble in water, but insoluble in absolute alcohol. It may be melted without undergoing chemical decomposition; its aqueous solutions, however, readily decompose on boiling. It is made on a large scale by heating yellow prussiate of potash (potassium ferrocyanide), the decomposition of the latter taking place according to the following equation:

$$\underset{\text{Potassium ferrocyanide}}{K_4Fe(CN)_6} = \underset{\text{Potassium cyanide}}{4KCN} + \underset{\text{Iron carbide}}{FeC_2} + N_2$$

The cyanide is separated from the carbide of iron formed along with it, by filtering through hot porous crucibles. Potassium cyanide is largely employed in extracting gold and in electro-plating. In the molten state it acts as a powerful reducing agent, readily setting free metals from their oxides; for example, lead oxide is reduced by it according to the following equation:

$$PbO + KCN = Pb + KCNO$$

Mercuric Cyanide, $Hg(CN)_2$, may be obtained by heating potassium ferrocyanide with mercuric sulphate in water, or by dissolving mercuric oxide in aqueous hydrocyanic acid. It is a colorless substance of a bitter metallic taste, and is moderately soluble in water and in alcohol. When heated it decomposes into metallic mercury and cyanogen gas. It is very poisonous, but is, in highly dilute solution, sometimes useful in syphilis and diphtheria.

HY'DRODYNAM'ICS (from Gk. *ὕδωρ*, *hydōr*, water + *δύναμις*, *dynamis*, power, from *δύνασθαι*, *dynasthai*, to be able). Strictly speaking, that branch of mechanics which is the application of dynamics to liquids; it should therefore include both the statics and the kinetics of liquids; that is, a study of their properties both when they are in equilibrium and when not. In general, however, the former phenomena are treated separately under hydrostatics (q.v.), leaving for hydrodynamics simply the phenomena of kinetics. Further, although gases are easily compressed, while liquids are not, yet, if a gas is flowing slowly and without great fluctuations, it will have properties closely resembling those of a flowing liquid. Consequently hydrodynamics also includes most of the phenomena of the kinetics of gases. If a liquid is flowing regularly through a tube of an irregular cross-section, or if a gas is flowing slowly and regularly through such a tube, the mass of the fluid which passes each point in the tube in a given time must be the same; otherwise there would be a state of compression or rarefaction somewhere in the tube; it follows, then, that where the tube is narrow the velocity must be large, and conversely, like a river flowing first through a lake and then through a narrow channel. If the velocity at any point in the tube is greater than at another, it shows that there must be a force acting in the direction from the second point toward the first, so as to increase the velocity of the moving fluid; but the force must always be produced by a *fall* in pressure, and so the pressure at the second point is greater than at the first. It follows, then, that in a fluid flowing *in a steady state* where the velocity is small the pressure is large, and conversely *if friction is supposed to be excluded.* This general principle is illustrated by the 'ball nozzle,' the injector of a boiler, the common atomizer, the 'ball in the fountain' experiment, and many others. If a fluid is flowing through a long pipe, e.g. water or gas in city mains, there is of course always a great amount of friction between the moving fluid and the layer that sticks to the tube. Owing to this, the pressure decreases along the pipe, and the velocity of flow is decreased also.

If an opening is made in the side of a vessel containing a liquid, the latter will make a jet out into air. If the opening is a small one in a *thin* wall, it may be observed that the cross-section of the jet a short distance from the wall is less than that of the opening itself: this place of smallest cross-section is called the 'vena contracta.' If a quantity of liquid of mass m escapes having a velocity v, its kinetic energy is $\frac{1}{2}mv^2$. This energy is evidently due to the fact that the effect inside the vessel is just as if these m grams had been taken off from the free surface; and so, if the centre of the opening is at a depth h below the free surface, the m grams have lost an amount of potential energy mgh. Therefore

$$mgh = \tfrac{1}{2}mv^2;$$
$$\text{or}\quad v^2 = 2gh.$$

This value of the velocity of efflux was first deduced by Torricelli, the pupil of Galileo. This theorem may be stated in a slightly different way. The liquid is forced out owing to a difference of pressure on the two sides of the opening equal to ρgh. (See HYDROSTATICS.) Calling this difference of pressure P, the formula for v^2 becomes

$$v^2 = 2\,\frac{P}{\rho}.$$

In this form it may be applied to the rate of escape of a gas from a vessel through a small opening in a thin wall. It is seen that the square of the velocity of efflux varies inversely as the density of the gas and directly as the pressure forcing the gas out, that is as the difference of the *partial* pressures of that particular gas on the two sides of the opening, regardless of what other gases are present or what their pressures are. (See EFFUSION.) If the escape of the fluid takes place through a thick wall or through a tube, the phenomena are entirely different, owing to friction. It is observed that the rate of escape is independent—within certain limits—of the material of the tube, showing that there is a layer of the fluid adhering to the inner walls of the tube, thus forming a tube of the fluid through which the flow takes place. The following formula has been found by experiment to hold approximately for capillary tubes:

$$v = \frac{Pr^2}{6\eta l},$$

where r is the internal radius of the tube, l is its length, and η is a constant.

If an obstacle is placed in a stream of liquid or of gas, it experiences certain forces. One of the most interesting cases is that of an oblong solid in a fluid stream; it will tend to place itself with its length at right angles to the current. This is illustrated by the fact that when a small piece of paper falls it does not do so edge down, but face down; if a coin is dropped in water, it falls face down, 'wabbling' as it sinks. (See PROJECTILE.) Other cases of fluid motion are too difficult for discussion here. It should be noted, however, that there are two great divisions of such motions: irrotational and rotational. The former is such that, if a small portion of the fluid were suddenly solidified and freed from the rest of the fluid, it would have simply motion of translation, no rotation. The latter is such that if a small portion of the fluid were suddenly solidified and freed from the rest of the fluid, it would be spinning round a definite axis. It was proved theoretically by Lagrange that if a certain portion of a perfect fluid free from viscosity was set in irrotational motion, it would never have its character changed (if certain conditions are satisfied, as they would be in general). Helmholtz has proved, further, that if a portion of a perfect fluid is moving rotationally, it will always do so; and that it is as impossible to produce this motion in a perfect fluid as it is to destroy it. He showed, too, how lines can be imagined drawn in the fluid so that at each of their points they coincide with the axis of rotation of the portion of fluid at that point. Such a line is called a 'vortex-line;' and a solid tube made up of such lines is called a 'vortex.' A vortex once existing in a perfect fluid moves through it, keeping its identity, i.e. always being made up of the same particles and preserving certain other properties. If two vortices were to collide they would rebound, being perfectly elastic. It is possible to devise many forms of vortices which are stable and can keep their general shape. Many of the properties of vortices can be imitated by smoke-rings, but the air is, of course, not a perfect fluid, and so the vortices do not persist.

HY'DRO-FER'RICYAN'IC ACID (from *hydro*-gen + *ferricyanic*), $H_3Fe(CN)_6$. A brown crystalline substance obtained by decomposing potassium ferricyanide with dilute mineral acids, in aqueous solution.

Potassium ferricyanide, or red prussiate of potash, $K_3Fe(CN)_6$, is a dark-red soluble crystalline salt obtained by passing chlorine-gas into solutions of potassium ferrocyanide (see HYDRO-FERROCYANIC ACID), the transformation of the latter taking place according to the following chemical equation:

$$\underset{\substack{\text{Potassium}\\ \text{ferrocyanide}}}{K_4Fe(CN)_6} + Cl = \underset{\substack{\text{Potassium}\\ \text{ferricyanide}}}{K_3Fe(CN)_6} + KCl$$

Potassium ferricyanide is used principally for making *Turnbull's blue,* or ferrous ferricyanide, $Fe_3[Fe(CN)_6]_2$, which is prepared by mixing potassium ferricyanide with ferrous salts in aqueous solution.

HYDRO-FERROCYANIC ACID (from *hydro*-gen + *ferrocyanic*), $H_4Fe(CN)_6$. A white crystalline substance readily soluble in water and in alcohol. If exposed to the air, it soon assumes a blue coloration. It may be obtained in the free state by decomposing an aqueous solution of its potassium salt with dilute mineral acids.

The *ferrocyanide of potassium,* $K_4Fe(CN)_6 + 3H_2O$, often called yellow prussiate of potash, is a yellow crystalline substance produced when a solution of potassium cyanide is boiled with ferrous hydroxide, the reaction taking place according to the following chemical equation:

$$\underset{\text{Cyanide of potassium}}{6KCN} + \underset{\text{Ferrous hydroxide}}{Fe(OH)_2} = \underset{\text{Potassium ferrocyanide}}{K_4Fe(CN)_6} + \underset{\text{Caustic potash}}{2KOH}$$

On a large scale, potassium ferrocyanide is made from animal refuse, such as dried blood, hair, horn-shavings, etc. These products are charred and then heated to a high temperature with scrap iron and crude potash. By this process the potassium carbonate contained in crude potashes combines with the charcoal and nitrogen of the refuse, and yields potassium cyanide; on the other hand, the scrap iron combines with the sulphur likewise contained in crude potash, forming sulphide of iron; and when potassium cyanide combines with iron sulphide, potassium ferrocyanide is produced. The chemical transformation taking place during this manufacturing process may, therefore, be represented by the following equations:

$$1.\ \underset{\text{Potassium carbonate}}{K_2CO_3} + \underset{\text{Carbon}}{4C} + \underset{\text{Nitrogen}}{2N} = \underset{\text{Cyanide of potassium}}{2KCN} + \underset{\text{Carbon monoxide}}{3CO}$$

$$2.\ \underset{\text{Cyanide of potassium}}{6KCN} + \underset{\text{Sulphide of iron}}{FeS} = \underset{\text{Potassium ferrocyanide}}{K_4Fe(CN)_6} + \underset{\text{Potassium sulphide}}{K_2S}$$

Large quantities of potassium ferrocyanide are at present made also from one of the by-products of the manufacture of coal-gas. When coal is heated out of contact with air, part of its nitrogen is obtained in the form of ammonium cyanide. In the manufacture of illuminating gas the cyanogen thus produced is for the most part retained by the iron oxide used in purifying the gas, and when the iron oxide has become useless for the latter purpose, it is employed in making potassium ferrocyanide after another valuable product, ammonium sulpho-cyanate, has been extracted from it with warm water. The mass remaining behind is mixed with lime and heated with steam; the calcium ferrocyanide thus produced is first transformed into potassium-calcium ferrocyanide $K_2CaFe(CN)_6$, by boiling with potassium chloride; finally, potassium ferrocyanide is obtained by heating the potassium-calcium salt with caustic potash.

Potassium ferrocyanide is extensively used for the manufacture of cyanide of potassium and of Prussian blue, as well as for a variety of other purposes.

Prussian blue, or Berlin blue, ferric ferrocyanide, $Fe_4[Fe(CN)_6]_3$, is obtained by mixing potassium ferrocyanide with ferric salts, in aqueous solution.

HY'DROFLUOR'IC ACID (from *hydro*-gen + *fluor*-ine), HF. An acid compound of hydrogen and fluorine, analogous to hydrochloric, hydrobromic, and hydriodic acids. It may be prepared by the action of sulphuric acid upon cryolite (q.v.) in an appropriate apparatus made of lead or of platinum. It may thus be readily obtained in liquid form, or rather in the form of an aqueous solution. The anhydrous acid may be obtained by heating acid potassium fluoride. As thus prepared, hydrofluoric acid is a colorless liquid, boiling at 19.5°C. (67.1°F.). Its vapors are exceedingly poisonous, and the liquid itself, even when mixed with more or less water, causes swellings on the skin that heal with extreme difficulty. Great care must therefore be taken in working with the acid. Solutions of hydrofluoric acid are used in analytical chemistry for breaking up minerals that are insoluble in strong hydrochloric and sulphuric acid; another way of breaking up such minerals consists in fusing them with the carbonates of sodium and potassium, but then, of course, the amounts of these metals in the mineral cannot be determined, and hence it is usually necessary to treat a separate portion of the mineral with hydrofluoric acid. Hydrofluoric acid dissolves glass, forming hydrofluosilicic acid (H_2SiF_6) with its silica, hence its use for making etchings on glass, the acid being, for this purpose, often replaced by its ammonium and certain other salts. (See ETCHING.) The acid is now often kept in bottles made of a wax-like substance called 'ceresine.'

HY'DROFLU'OSILIC'IC ACID. See HYDROFLUORIC ACID.

HY'DROGEN (from Gk. ὕδωρ, *hydōr*, water + -γενής, *-genēs*, producing, from γίγνεσθαι, *gignesthai*, to become). A gaseous element, discovered in 1766 by Cavendish, who called it 'inflammable air.' Paracelsus had already obtained hydrogen by treating iron with dilute mineral acids. But the existence of gases essentially different from air was not generally recognized until about the middle of the eighteenth century, and the properties of hydrogen gas were not definitely known before the researches of Cavendish. Lavoisier recognized its elementary nature, and gave it its present name. In the free state, hydrogen is found in the exhalations from volcanoes, in the gases issuing from the salt beds at Stassfurt and Wieliczka, in gases given off by oil-wells, in the intestinal gases of animals, etc. The spectroscope reveals its existence in the atmosphere of the sun and of many stars, and it has been found 'occluded' in meteorites. In combination it occurs as water, of which it forms very near one-ninth by weight, and as a constituent of almost all organic matter. It may be obtained by the electrolysis of acidulated water; by the action of sodium, potassium, and certain other metals on water; by passing steam over red-hot iron wire, etc. But the most convenient method, and the one generally employed, consists in allowing dilute hydrochloric acid, or preferably dilute sulphuric acid, to act on metallic zinc. Owing, however, to the impurities ordinarily present in zinc, as well as in mineral acids, the hydrogen thus obtained is impure and has a disagreeable odor. A large percentage of hydrogen is contained in ordinary coal-gas, in which it is formed as a product of the destructive distillation of coal (organic matter). Much hydrogen is also contained in ordinary water-gas, in which it is formed by the action of red-hot coal on water-vapor.

Hydrogen (symbol H; atomic weight—either 1, the standard of atomic weights, or 1.01, when the figure 16 for oxygen is adopted as the standard; see ATOMIC WEIGHTS) is a colorless, tasteless, and odorless gas, whose critical temperature is —234.5°C., the critical pressure being 20 atmospheres (300 pounds to the square inch). It was first solidified in 1899, by causing it rapidly to evaporate when in the liquid state. In the gaseous state, it is the lightest substance known, being fourteen and one-half times lighter than atmospheric air, and about 256,000 times lighter than the mineral platiniridium. One liter, at

0° C. and under normal atmospheric pressure (760 millimeters of mercury), weighs .08952289 gram. In accordance with the atomic and molecular theory, the molecule of ordinary gaseous hydrogen is assumed to consist of two atoms, and is therefore usually represented by the formula H_2. The gas burns in the air with a non-luminous flame of very high temperature, combining with the oxygen to form water. When pure, though it cannot support animal life, hydrogen is not poisonous, and when mixed with a sufficient quantity of oxygen or atmospheric air, may be inhaled for some time without inconvenience; but it weakens the voice, and renders it high-pitched. Hydrogen gas is capable of being absorbed by certain metals, such as iron, platinum, and especially palladium. Graham, who studied this phenomenon, maintained that when thus 'occluded' hydrogen assumed a true metallic form, and named that form of the element *hydrogenium*. Troost and Hautefeuille, too, believed that hydrogen is capable of forming *alloys* with metals, and some of the alloys obtained by them were found to have the composition of true chemical compounds; for example, the hydride of sodium, Na_2H, and the hydride of potassium, K_2H. If this is true, then hydrogen cannot be assumed to be invariably univalent in its compounds. (See VALENCY.) At ordinary temperatures, hydrogen is chemically inert toward most of the other elements; with chlorine, however, it combines gradually in diffused, and with explosive violence in direct, sunlight. Its mixture with double its volume of oxygen explodes violently if ignited; the explosion is somewhat less violent if instead of two volumes of oxygen, about two and a half volumes of air are mixed with one volume of hydrogen. At elevated temperatures, or when in the nascent state (i.e. while being formed, say by the action of dilute acid on zinc), hydrogen is a powerful reducing agent, i.e. it readily abstracts oxygen from compounds or adds itself to them. Nascent hydrogen is thus often employed in the preparation of organic compounds from given materials. With oxygen, hydrogen forms two different compounds: water, H_2O, and hydrogen peroxide, H_2O_2. With sulphur it combines directly, at the boiling temperature of the latter, forming sulphureted hydrogen, H_2S. The ordinary compound of hydrogen with nitrogen is ammonia, NH_3; another compound of hydrogen and nitrogen, termed hydrazine, has the formula N_2H_4. Hydrochloric acid, HCl, is the compound of hydrogen with chlorine, the two elements combining, as stated above, under the influence of sunlight at ordinary temperatures. At somewhat elevated temperatures, hydrogen similarly combines with the vapors of bromine and iodine, forming, respectively, hydrobromic acid, HBr, and hydriodic acid, HI. For the compounds of hydrogen with phosphorus, see PHOSPHORUS. For its compounds with carbon, see HYDROCARBONS.

Among the ordinary uses of hydrogen may be mentioned its use for the production of high temperatures, as in the ordinary oxy-hydrogen flame. In ordinary illuminating gas, hydrogen acts as a diluent for the light-giving constituents, and its combustion yields much of the heat without which the flame could not be luminous. On account of its great lightness, hydrogen is used to give buoyancy to balloons.

HYDROGEN, SULPHURETED. See SULPHURETED HYDROGEN.

HYDROGEN DIOXIDE, PEROXIDE OF HYDROGEN, or OXYGENATED WATER, H_2O_2. A colorless compound of hydrogen and oxygen containing, for the same amount of hydrogen, twice as much oxygen as water. It was discovered in 1818 by the French chemist Thénard. Minute quantities of it occur in the air, in rain-water, and in snow, and, according to some, in the juices of certain plants. It may be prepared by the action of cold diluted hydrochloric or sulphuric acid on hydrated barium peroxide. It can also be prepared by the action of hydrofluoric, hydrofluosilicic, phosphoric, or compressed carbonic acid on barium peroxide; and it has been prepared on a somewhat large scale by the action of acids on the peroxide of sodium. By any of these methods the peroxide is obtained in the form of a dilute aqueous solution. This may be concentrated by allowing the water to freeze out, or by passing a current of dry air through the solution kept at ordinary temperatures, or by allowing it to evaporate in a vacuum over sulphuric acid. The anhydrous peroxide thus obtained is a colorless, odorless, oily liquid with a harsh, bitter, metallic taste. It remains unfrozen at —30° C., and when heated to the boiling-point of water it decomposes with violence into oxygen and water. When brought in contact with the skin it causes a white blister, which after a time produces an irritating, itching sensation. It is a powerful bleaching agent and is largely used to remove color; it is particularly valuable for bleaching ostrich-feathers, bones, ivory, silver, wood, silk, cotton, etc. Dilute solutions of it under special trade names are employed to produce a light color in hair. It has also been used to restore paintings that have become darkened by age. The peroxide is very useful in medicine and surgery as an antiseptic, rapidly destroying pus and similar discharges, in consequence of which it has been employed in diphtheria. Hydrogen dioxide has the power of freeing water from micro-organisms, which has led to its use in brewing. It also destroys the acid and mold ferments in the wort. If taken internally, it has the effect of improving digestion, and has therefore been used in certain forms of dyspepsia. Ordinarily the peroxide acts as a strong oxidizing agent, owing to the ease with which it parts with half of its oxygen. In certain cases, however, the same property has the effect of causing reduction. This happens, namely, whenever the peroxide is brought into contact with substances like oxide of mercury, or ozone, which readily undergo decomposition. The reduction of such substances is accompanied by the evolution of much heat, great volumes of oxygen being given off by the peroxide itself as well as by the substances undergoing reduction. The peroxide itself is readily decomposed into water and free oxygen by mere contact with certain substances, e.g. gold, without these undergoing any change. Among the substances that have this effect on the peroxide are most alkalies, and hence the peroxide can only be preserved in slightly acid solution. Before using such a solution, a few drops of ammonia may be employed to neutralize the acid.

HYDROGEN SULPHIDE. See SULPHURETED HYDROGEN.

HYDROGRAPHIC OFFICE. A Government institution for the preparation, publication, and distribution of charts, and nautical information. It is a bureau, or office of a bureau, in the Navy Department. The principal hydrographic offices of the world are the British, French, United States, Russian, German, Italian, Japanese, Netherlands, and Spanish. The United States Hydrographic Office is third in the number of different charts published. It was established by act of Congress approved June 21, 1866. Before that date both the navy and merchant marine depended upon foreign offices for their supply. Charts for the navy were supplied through a depot of charts located in Washington, which purchased and kept on hand the charts needed for use. The Navy Department published a few charts prior to the establishment of the Hydrographic Office—notably those of the Wilkes Exploring Expedition—but such publications were exceptional.

The present Hydrographic Office was for a time a branch of the Bureau of Navigation of the Navy Department, but some years since it was transferred to the Bureau of Equipment. It is composed of the divisions of Chart Supply, Chart Construction, Sailing Directions, and Meteorology. The head of the Office, a captain or commander, is styled the *Hydrographer to the Bureau of Equipment.* The chiefs of divisions except that of Chart Construction are naval officers; the chief of the division of Chart Construction is a hydrographic engineer, and in 1901 was an ex-naval officer. On July 1, 1901, the number of engraved chart plates on hand was 1169, in addition to which there were 28 photographic plates. Besides these a considerable number of charts are produced by photolithography for temporary use until the engraved plates can be prepared. The total number of charts published and sold or issued to United States vessels or for governmental purposes during the preceding fiscal year was 62,194.

In addition to charts of the usual character there were published about 50,000 copies of the Pilot Chart (see Pilot Chart) of the North Atlantic Ocean, and 21,000 copies of the Pilot Chart of the Pacific Ocean. The Office also issues weekly a pamphlet of several pages called *Notices to Mariners,* which give accounts of all newly discovered dangers and changes in lighthouses, buoys, and aids to navigation reported during the week, and other information of importance to navigators; of these pamphlets 885,725 copies were published during the fiscal year 1900-01. The pilot charts are only issued monthly, and a weekly supplement called the *Hydrographic Bulletin* serves to bring the information up to date. The Office publishes lists of lighthouses, buoys, etc., throughout the world, and volumes called sailing directions, which contain full information in regard to ocean currents, weather, character of the seacoasts of different parts of the world, descriptions of harbors, aids to navigation, and other matters of interest to navigators and mariners generally. The other publications of the Office are *Bowditch's Practical Navigator* (q.v.), *Azimuth Tables,* and similar books for the use of mariners.

For the purpose of gathering and disseminating information of interest to mariners and assisting them as much as possible, branch hydrographic offices have been established in the ports of Baltimore, Boston, Buffalo, Chicago, Cleveland, Duluth, Galveston, New Orleans, New York, Norfolk, Philadelphia, Portland (Me.), Portland (Ore.), Port Townsend, Sault Ste. Marie, San Francisco, and Savannah. Additional branches are contemplated in Porto Rico, Hawaiian Islands, and the Philippines. The charts published by the Hydrographic Office cover the Great Lakes and their coasts and harbors, the Philippines, Samoa, Hawaiian Islands, Guam, Porto Rico, foreign territory, and the oceans. Only general sailing charts of the United States' own coast are published by it, the detail charts being published by the United States Coast Survey.

For further information, consult: Hughes, *Founding and Development of the Hydrographic Office* (Washington, 1887); and *Annual Reports* of the Hydrographer to the Bureau of Equipment (Washington). See Hydrography; Chart; and section on Navy under United States.

HYDROG′RAPHY (from Gk. *ὕδωρ, hydōr,* water + *-γραφία, -graphia,* writing, from *γράφειν, graphein,* to write). That branch of the science of physical geography which treats of the surface waters of the earth particularly with reference to their bearing on navigation. Practically every civilized nation, and particularly all maritime nations, have special governmental departments whose duty it is to survey and chart the navigable waters belonging to the nation, and also the waters of the oceans wherever navigation extends. The hydrographical work performed by these organizations may be divided into two branches: (1) The collection of hydrographic data; and (2) the recording of these data, and marking the records available for the mariners. In the succeeding discussion these two branches of hydrographic work will be considered separately. First, however, it will be interesting to note very briefly the earliest attempts at systematic hydrographic work. The first step in the modern science of hydrography was made in the fifteenth century by Henry, 'The Navigator,' who was the first to construct a sea chart worthy of the name. Not much of importance in the way of hydrographic work was accomplished, however, until Captain James Cook, of the English Navy, commenced his long career of ocean surveying in 1759. Captain Cook's first work was the hydrographic mapping of the Saint Lawrence River from Quebec to the Atlantic Ocean, which he accomplished while stationed with the British fleet coöperating with General Wolfe in the attack upon Quebec. In 1763 Captain Cook was sent to survey the coast waters of Newfoundland, and in 1764 he performed a similar duty for the coast of Labrador, and thereafter he continued similar hydrographic observations wherever he was ordered until his death in 1779. The French had been observers of the operations of Captain Cook, and in 1785 La Pérouse was sent with two ships and a corps of scientists to visit the northwest coast of America and to explore other parts. He made important observations there, and also on the northeast coast of Asia. After spending two years and a half he went to Botany Bay, after which he was never heard from, except that information was obtained seven or eight years afterwards which made it probable that the ships were wrecked on a coral reef on the coast of Mallicollo. La Pérouse had, however, sent duplicates of charts and journals up to the time of his arrival at Botany Bay. The navigating officer of the expedition, Beautemps-Beaupré, sent out to search for La Pérouse in 1791 under the command of D'Entrecasteaux, wrote a work on marine surveying, which was published in an appendix to the narrative of the voyage (1808). This, however, had been preceded by Alexander Dalrymple's essay on marine surveying, published in 1771. Beautemps-Beaupré was placed in charge of the survey of the French coast, where he trained a number of hydrographers, the commencement of a corps of engineers for future exploration and surveying. The work done by these early English and French navigators was imitated by those of other nations, and now, as previously stated, practically every civilized nation has its hydrographic office.

COLLECTION OF HYDROGRAPHIC DATA. The sources from which hydrographic data are gathered are numerous. One of the most important is the system of surveys made directly by the Hydrographic Office (q.v.). Some of the objects of these surveys are the determination of depths for mapping and navigation purposes; the location of buoys, rocks, signals, etc.; the location of channels, the directions and velocities of currents, and the determination of the changes in the same, the measuring of the cross-sections of streams, the mean velocities of the water across such sections, and the slope of the water surface, and the determination of the quantity of sediment carried in suspension, the volume of scour or fill on the bottom, or of the material removed by artificial means as by dredging. The fixed points of reference for the survey are usually on shore, but sometimes buoys are anchored off shore and used as points of reference. The depth of water is determined by taking soundings along certain definite lines, these lines being established from the reference points just mentioned in coast and harbor work, and by the sextant and mariner's compass in deep-sea work. The operation varies in its nature, but consists commonly in rowing a boat at uniform speed and making soundings at regular intervals of time. The steersman keeps the boat true to the line by starting from a known point and steering directly toward another known visible point. In deep-sea sounding the ship keeps to a compass course, the latitude and longitude being established at suitable intervals by the ordinary means. In a harbor survey the soundings are generally taken along two sets of parallel lines, one set crossing the other at approximately right angles, and thus dividing the harbor area into checkerboard divisions. In river work the soundings are usually made along lines crossing the streams transversely at regular intervals.

Numerous modifications of these two methods are practiced. The means used for making the sounding or measuring depth ranges from a long graduated rod in shallow waters to the deep-sea lead. (See LEAD, SOUNDING.) To determine the direction and velocities of currents various means are employed, the most perfect of which are ingenious instruments known as current-meters (q.v.). In these devices a small water-wheel or screw propeller is operated by the current, and registers the number of revolutions made. As the wheels are regulated to make a certain number of revolutions at each speed of current, the registered record shows by a simple calculation the velocity of the current at the point where the meter was sunk. For collecting samples of the subsurface water instruments are used which consist essentially of a small water-tight vessel which can be tightly closed below water, and thus enable a sample to be brought to the surface by means of the line to which the instrument is attached. For obtaining samples of the bottom the sounding-lead may have a cup-shaped vessel, with self-closing cover, attached to it, or a deep-sea dredge may be employed. See DEEP-SEA EXPLORATION; DREDGE.

The great bulk of the hydrographic surveying done by commercial nations is performed in the waters contiguous to the coast-lines, since it is here the shoals, reefs, currents, etc., whose location is of concern to the mariners, are chiefly found. Deep-sea surveying is more purely of scientific interest only, the principal direct commercial purpose of such deep-water surveys being the location of submarine telegraph cables.

Turning now to the sources for gathering hydrographic data outside of the surveys conducted directly by the Hydrographic Office, reference has already been made to the surveys performed in locating submarine cable routes. The various cable companies have ships continuously at work making such surveys or repairing and relaying old cables, and the numerous data collected by these vessels are forwarded to the Hydrographic Office for record and compilation. In the United States the Hydrographic Office also has the aid of the work done by the Coast and Geodetic Survey in surveying and mapping the coast-line, by the Engineer Corps United States Army in improving harbors and rivers, and by the United States Lighthouse Board in establishing lighthouses, buoys, beacons, etc. In addition the United States Commission of Fish and Fisheries collects considerable hydrographic information in the course of its work which is of value to the hydrographer. It is also the accepted duty of every master of a vessel to report to the proper authorities every fact of importance to mariners which he may observe in his voyages. Finally, there are the various expeditions which are organized from time to time, sometimes by the Government and sometimes by scientific bodies, to study the physical geography of the ocean. The first, and in some respects the most important, of these expeditions was that of the *Challenger*, sent out by England in 1872, and a reference to the brief description of its work (see CHALLENGER EXPEDITION) will serve to explain the nature and purpose of subsequent similar expeditions.

The hydrographic work so far mentioned has referred exclusively to navigable waters. In recent years constantly increasing attention has been devoted to the conservation and utilization of surface waters for irrigation in arid regions, for water-power and water-supply, and for various other utilitarian purposes. In the United States there is a special department of the Geological Survey devoted to the collection and publication of hydrographic data of this sort. Similar work is done by other governments, particularly that of England in India. As in the case of navigable waters, here also much information is obtained from the work done in developing private enterprises, such as water-power and water-works undertakings.

RECORDING AND PUBLICATION OF HYDROGRAPHIC DATA. The work of placing on record and making public the facts collected by the Hydrographic

Office through its surveys, and from other sources of information, is quite as important as the work of collecting such facts. In this way only is it possible to make the collected facts of value. So far as the mariner is concerned the most important work of the Hydrographic Office is the charts of navigable waters which it issues. These charts are made up by compiling the data collected as previously described, and then constructing maps or charts, showing the configuration of the coast-line and the ocean bottom, the depths of water, the location of channels, rocks, reefs, buoys, lighthouses, etc. As changes occur in these particulars they are recorded, and new charts made showing the changed conditions. Information which is not suitable for representation on charts is published in book form, or in periodicals called *Notices to Mariners*. When it is stated that the Hydrographic Office of each nation publishes not only its own charts, reports, and notices, but reproduces a considerable portion of the similar information published by other nations, it will be seen that the task of recording and making public hydrographic information is one of magnitude. See HYDROGRAPHIC OFFICE.

HY'DROID (from Gk. *ὑδροειδής*, *hydroeidēs*, like water, from *ὕδωρ*, *hydōr*, water + *εἶδος*, *eidos*, form). One of a class of cœlenterate animals, notable for their delicacy and beauty, and receiving their name from their structural resemblance to Hydra (q.v.). The name is now generally restricted to the polyp forms of the Hydromedusæ. (See HYDROZOA.) They exist in compound colonies, one kind having the office of feeding the community, another of protecting it, and another of reproduction. The feeding hydroids are usually fixed, or attached to some object, and proceed from eggs of the reproductive hydroids, or medusæ, the latter in turn growing from buds produced by the former. The medusæ sometimes remain attached to the stem, or become free-swimming. The body of the nutritive hydroid is usually supported by a stem of variable length, but may rest immediately upon the bottom. From one individual buds appear and produce branching colonies of hundreds or thousands, often having a height of fifteen or twenty inches, and the giant hydroid of Japan is more than three feet high. The reproductive hydroids are sometimes developed into perfect medusæ before leaving the parent stem, but they usually break away before attaining their perfect state. Some buds never become much developed, and are called gonophores. These usually remain attached, but attain sexuality and reproductive power. Most hydroids are covered with a chitinous envelope, which is continuous over the branching stem of the entire colony, but some species are naked, and soft. In tubularian hydroids, the chitinous envelope, when present, simply incloses the stem and branches, but is not expanded around the individual polyps (*hydranths*) in the form of a cup. In campanularian hydroids, however, each hydranth is surrounded by a cup, a continuation of the chitinous envelope, into which it can withdraw itself. Hydroids abound in the ocean in various parts of the world, notably the northwest coast of America, the Caribbean Sea, and around Australia. Their colors are usually not brilliant, brown, flesh-color, and white being the most common. A familiar and beautiful example is the Portuguese man-of-war (q.v.). Consult Agassiz, *North American Acalephæ* (Museum of Comparative Zoölogy, Cambridge, 1875). See SIPHONOPHORA, ALTERNATION OF GENERATIONS, and the accompanying illustration.

HY'DROMAN'CY. See DIVINATION.

HYDROM'ETER (Gk. *ὑδρομέτριον*, *hydrometrion*, vessel for hydrostatic measurement, from *ὕδωρ*, *hydōr*, water + *μέτρον*, *metron*, measure), also known as AREOMETER. An instrument used in determining the specific gravity of liquids, and in some instances of solid bodies.

Specific gravity, for determining which the hydrometer is used, is the ratio between the weight of a given quantity of a substance and that of an equal volume of water at its temperature of maximum density, 4° Centigrade, so it follows that the specific gravity of two substances must be directly proportional to their weights when the volumes are the same, or inversely as their volumes when the weights are equal. The hydrometer, which is a hollow instrument of glass or metal designed to float upright in a liquid, makes use of the principle of Archimedes that the weight of the volume of liquid displaced by a body is equal to the weight of the body itself. In its simplest form a hydrometer might consist of a graduated scale floating vertically in a liquid, and on which the level of the surface of the liquid it displaces could be measured. For example, an ordinary ruler if allowed to float upright in water would sink until a certain division on the scale is reached. This reading multiplied by the area of the cross-section of the ruler will give the volume of a mass of water equal to that displaced by the ruler, and equivalent to the weight of the ruler itself. Immersing the ruler in a liquid of different specific gravity, it will sink until the surface touches some other division on the scale, and as before the volume of a mass equivalent to the weight of the ruler will be obtained. A ratio made with these two quantities representing the volumes of the two liquids would give the specific gravity, but as the cross-section of the ruler is a constant quantity, it is only necessary to compare the two readings on the scale. The ordinary hydrometer consists of a glass tube terminating in two bulbs, the lower of which is filled with mercury or shot in order to keep the instrument steady in an upright position when immersed in a liquid. Such a hydrometer is extensively used in scientific and commercial work, as it can be graduated to furnish direct readings of the specific gravity of a liquid. The mark to which the instrument would sink when placed in water is usually marked 1.000, and the weight of water displaced is equal to the total weight of the hydrometer. If the instrument be placed in a liquid that has a less specific gravity than water, alcohol for example, it will sink until the surface of the liquid touches some point higher up on the stem, as in this case it takes a greater volume of the lighter liquid to be equivalent to the weight of the hydrometer. The scale on which the readings are made is on a piece of paper contained inside of the stem, and the method of graduation forms the chief distinction between the different instruments. In the instrument of Gay-Lussac, which is known as a volumeter, the water-point was marked 100, and the division was carried along the stem both above and below this mark on the basis that the amount of the stem between any two scale divisions should equal $\frac{1}{100}$ of the volume of the part immersed in water. With an instrument graduated in this manner the specific gravity is obtained by dividing the reading into 100. In practice, it is more convenient to use a hydrometer whose scale is graduated to read specific gravity direct, but in this event the scale is irregular, and great care must be exercised in the construction and testing of the instrument. The accuracy of a hydrometer is greatly increased by making its stem as slender as possible, and consequently increasing the space between the divisions, so it is customary to construct a number of instruments, each having a limited range, and designed for liquids of different densities. The hydrometer when used for a special purpose or substance, frequently undergoes modifications. The alcoholmeter, for example, is so graduated as to give at once the percentage of pure alcohol in a mixture of alcohol and water. The urinometer, lactometer, sacharimeter, and other instruments are all hydrometers used for special purposes. Hydrometers with arbitrary scales also play an important part in scientific work, though the present tendency is toward the exclusive use of specific gravity values. In the Baumé scale, which is encountered frequently in chemical processes, a second fixed point on the hydrometer stem is determined in addition to that given by water. This is obtained by dissolving one part by weight of common salt in nine parts of water, and then the space between these two points is divided into ten equal parts, which are called degrees. The water-point is marked 10 on the scale, and the division is carried beyond for 40 degrees. For liquids heavier than water the second fixed point is determined by immersion in a solution of 15 parts of salt in 85 parts of water, and the space between it and the water-point, which is marked 0, is divided into 15 equal divisions. The scales of Cartier and Beck are also used, though less frequently than that of Baumé.

The following tables from Kohlrausch, *Leitfaden der praktischen Physik* (Leipzig, 1900), afford a comparison of these scales with the true values of specific gravity:

LIQUIDS LIGHTER THAN WATER

SP. GR.	Baumé	Beck	Cartier
.75	58.4°	56.7°	......
.80	46.3	42.5	43.°
.85	35.6	30.	33.6
.90	26.1	18.9	25.2
.95	17.7	8.9	17.7
1.00	10.	0.	11.

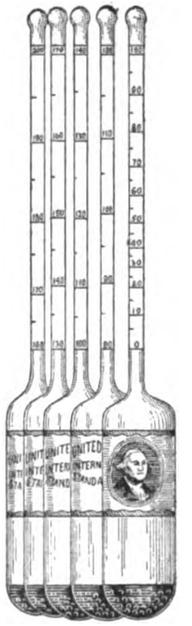
LIQUIDS HEAVIER THAN WATER

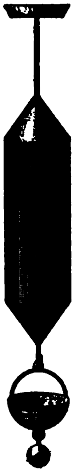
SPECIFIC GRAVITY	Baumé	Beck
1.0	0.0°	0.0°
1.1	13.2	15.4
1.2	24.3	28.3
1.3	33.7	39.2
1.4	41.8	48.6
1.5	48.8	56.7
1.6	54.9	63.7
1.7	60.	70.
1.8	65.	76.
1.9	69.	81.
2.0	73.	85.

The specific gravity of liquids changes with the temperature so that it is of the utmost importance to have the liquid at the temperature for which the instrument is made, or to use a thermometer, and then apply suitable corrections. For this purpose many of the finer hydrometers contain within their stems a thermometer tube whose bulb is placed in the lower portion of the instrument.

In the United States Internal Revenue Service the hydrometers furnished to the inspectors are so graduated as to indicate the number of parts by volume of proof spirit equivalent to the volume of the liquor at the standard temperature, which is 60° Fahrenheit. They are constructed so as to read 100 for proof spirit, and 200 for absolute alcohol. Proof spirit in the United States is defined by law to be that mixture of alcohol and water which contains one-half of its volume of alcohol, the alcohol when at a temperature of 60° Fahrenheit being of specific gravity .7939 referred to water at its maximum density. Proof spirit has at 60° Fahrenheit a specific gravity of .93353, 100 parts by volume of the same consisting of 50 parts of absolute alcohol, and 53.71 parts of water.

A hydrometer of a different type from those described above is the weight hydrometer, where the submerged volume remains constant, but as the specific gravity of the liquids changes, the weight of the instrument must be varied in order to immerse it to a given point. The Nicholson hydrometer is representative of this class, and consists of a brass tube with conical ends, which floats upright and carries above a thin stem the carrying pan in which may be placed a substance whose specific gravity is to be found. When used to determine the specific gravity of a liquid the weight of the apparatus is first ascertained, and then it is placed in water and weights added until a marked point on the stem is at the surface of the water. If the instrument is placed in a liquid of greater specific gravity, then additional weights must be placed on the pan in order to sink the stem to the mark, while if the liquid is less dense the number of the weights must be diminished. The weight of the instrument increased by the amount of the weights added when the instrument was placed in water, divided by the weight of the instrument and the weights added when the instrument was in the liquid under test, will give the specific gravity. This hydrometer can also be used to determine the specific gravity of a solid, in which case the latter is first placed in the upper pan, while the instrument is in water, and the number of weights which must be removed is noted. The substance is then placed in the lower pan, and the amount of weight which must be removed to restore it to its former position ascertained. The difference in the two amounts


SET OF UNITED STATES STANDARD HYDROMETERS AS USED BY THE INTERNAL REVENUE OFFICE.



NICHOLSON HYDROMETER.

represents the weight of the water displaced by the substance, and if divided into the sum of the weights removed when the body was placed in the upper pan, will give the specific gravity. The hydrometer of Fahrenheit is based on a similar principle, but is made of glass instead of metal, and has a bulb filled with mercury at its lower end instead of a weighted cup. It can only be used for liquids. These instruments are not as reliable as the ordinary hydrometers, and are not as widely used. In the most accurate determinations of specific gravity a chemical balance is employed, and equal volumes of the liquid actually weighed, or if the substance is a solid it is weighed both in the air and in distilled water, suitable corrections being applied for temperature, and other disturbing influences.

The hydrometer is without doubt one of the earliest pieces of physical apparatus, its invention being generally ascribed to Archimedes, to whom is due the principle on which it is based. The instrument is mentioned by Priscian, who died about A.D. 500, and it is also described by Synesius of Ptolemais in a letter to Hypatia of Alexandria, under the name of hydroscopium, as follows: "It is a cylindrical tube the size of a reed or pipe, a line drawn along it lengthwise which is intersected by others, and these point out the weight of water. At the end of the tube is a cone the base of which is joined to that of the tube so that both have but one base. This part of the instrument is called *baryllion*. If it be placed in water it remains in perpendicular direction so that one can readily discover the weight of the fluid." The date of this letter can be approximately fixed by the fact that Hypatia was murdered in A.D. 415. The use of the hydrometer was known to the Saracens of the tenth and eleventh centuries, and one of their writers, Al-Khâzinî, attributes its invention to a Greek philosopher named Poppius, a contemporary of Theodosius the Great. In this connection this same writer refers to the fundamental discovery of Archimedes.

HY'DRONI'TRITES. See HYDRONITROUS ACID.

HY'DRONI'TROUS ACID, HN_3. An acid gaseous compound of hydrogen and nitrogen first obtained by Curtius in 1890. An easy method of preparing this acid was subsequently worked out by Angeli, and consists in adding hydrazine hydrate (see HYDRAZINE) to a concentrated solution of silver nitrate, the result being a precipitate of silver, hydronitrite, AgN_3, from which free hydronitrous acid may be obtained by decomposing with sulphuric acid. The salts of hydronitrous acid, or *hydronitrites*, are violently explosive compounds, and their preparation should not be undertaken by inexperienced persons.

HYDROP'ATHY (from Gk. *ὕδωρ, hydōr*, water + *πάθος, pathos*, disease). A synonym for hydrotherapy, the method of treating diseases by external and internal use of water. See HYDROTHERAPY.

HY'DROPHANE (from Gk. *ὕδωρ, hydōr*, water + *φανός, phanos*, clear, from *φαίνειν, phainein*, to appear). A translucent variety of opal that is either whitish or light-colored, and becomes more transparent or translucent in water.

HYDROPH'IDÆ. See SEA-SNAKE.

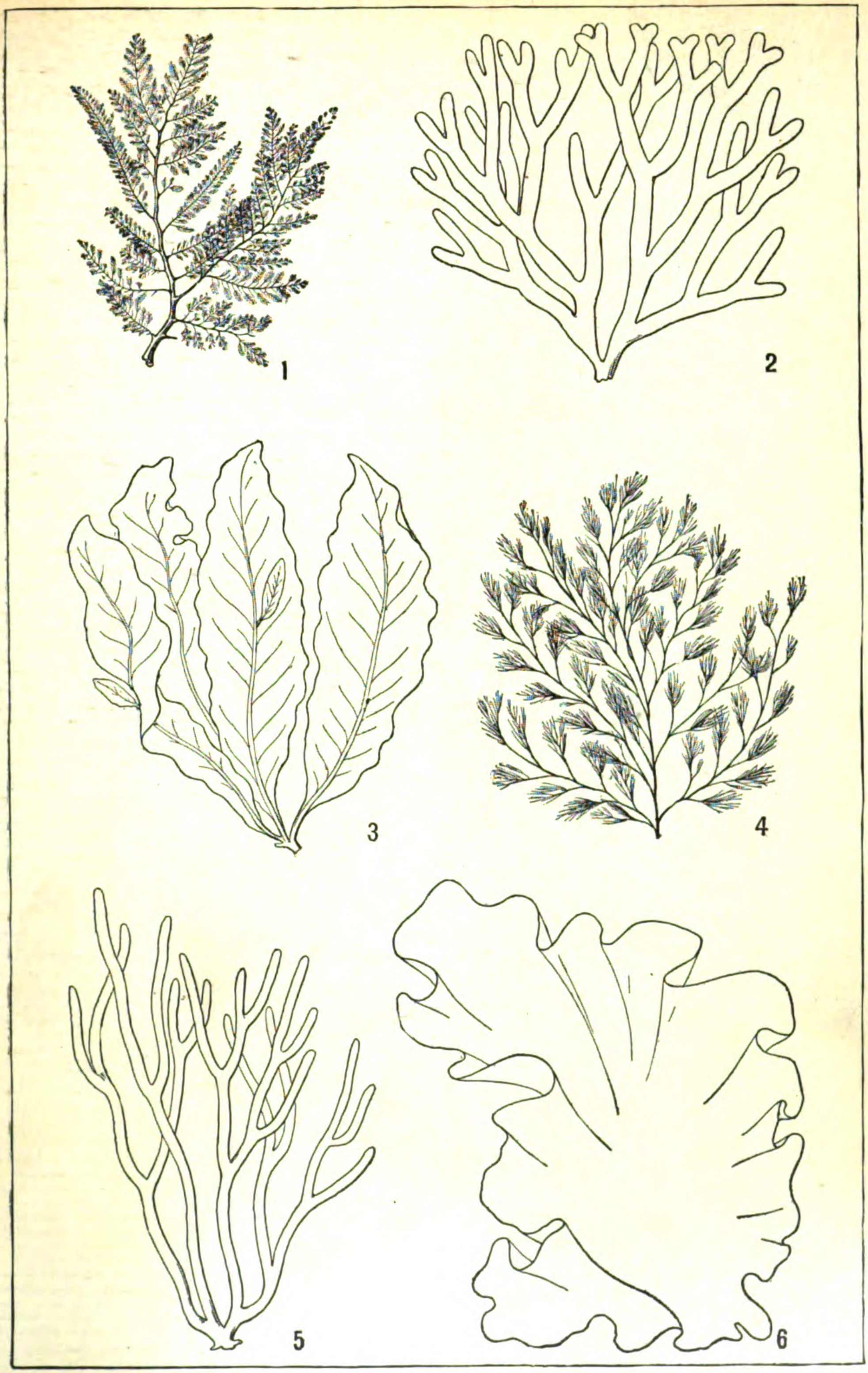
HY'DROPHIL'IDÆ (Neo-Lat. nom. pl., from Gk. *ὕδωρ, hydōr*, water + *φίλος, philos*, loving). A family of scavenger beetles, most of which swim in the water or crawl on the submerged parts of plants in quiet pools. They are elliptical black beetles with club-shaped antennæ. Because of the fact that they carry a film of air on the ventral surface of the body, this part has a silvery appearance. The larvæ are carnivorous, but the adult beetles live chiefly on decaying vegetation. There are one hundred and fifty species of this family in the United States. One of the most common species is *Hydrophilus triangularis*. A few forms live in moist earth or dung, and subsist upon maggots which inhabit such places.

HYDROPH'ILOUS. A term which has been applied particularly to plants which are pollinated through the agency of water. It has also been applied by some authors to hydrophytic plants, but should be entirely discarded there, both because of its previous use in another sense and because it is an undesirable word in all senses. The term water-pollinated is preferable in the first sense. See POLLINATION.

HY'DROPHO'BIA (Lat., from Gk. *ὑδροφοβία*, hydrophobia, from *ὑδροφόβος, hydrophobos*, dreading water, from *ὕδωρ, hydōr*, water + *φόβος, phobos*, fear), or RABIES, also called LYSSA. An acute infectious disease of warm-blooded animals produced in man by the implantation of a specific virus through the bite of an animal sick with the disease. This disease has been known since the earliest historical times. Democritus of Abdera gave an account of it in the fifth century B.C. Aristotle in the fourth century B.C. described it. Celsus, B.C. 21, detailed some of its symptoms. Xenophon, Ovid, Vergil, Horace, Plutarch, all referred to rabies in their works. Boerhaave (q.v.) and Van Swieten described the disease intelligently. John Hunter (q.v.), Magendie (q.v.), Marochetti, Morgagni, Trousseau, and Dupuy all wrote of it. Youatt (1850), the celebrated veterinarian, considered rabies at length in his books, and relied on early cauterization with nitrate of silver to obviate infection. Yet after being bitten seven times with impunity, he is reported to have died of rabies at the last. Virchow and Von Ziemssen propagated the disease by the hypodermic injection of saliva of a rabid animal. After many others had added to our knowledge of hydrophobia, Pasteur (q.v.), in 1882, began to treat the disease with scientific accuracy.

The geographic distribution of the disease is wide. It has been found in Greenland, where it was epidemic in 1860; in Constantinople, where it prevailed in 1830; in Egypt, in London, in Hamburg, in Saxony, in Bavaria, and in many parts of the United States, the prevalence of the disease in Washington, D. C., in 1899-1900 raising grave apprehension. In Russia and Siberia very many instances of rabid wolves have been recorded. The disease is found most frequently in the dog, the wolf, the cat, and the cow. The skunk, also, seems to be peculiarly liable to hydrophobia, and the disease in this animal has

HYDROPHYTES



RED ALGÆ

1. Ptilota californica
2. Scinaia furcellata
3. Delesseria sanguinea
4. Polysiphonia Brodiaei
5. Nemalion multifidum
6. Porphyra laciniata

been considered distinct and worthy its own name of *rabies mephitica.* A careful consideration of all the known facts, however, leads to the conclusion that the disease is one to which all the lower animals, and man also, are liable; that it is protean in its manifestations, chiefly because of the thousand and one concomitant circumstances and elements; and that the collected statistics are mostly so tainted, from manifold sources of error, that they need to be scanned and sifted with the utmost discretion and care. It is, however, safer to treat every skunk-bite as though certainly by a rabid animal, since in most cases the facts cannot be known. (The curious will find the question most interestingly discussed in a candid manner in Coues's *Fur Bearing Animals.*) The nature of the infecting virus is as yet unknown. It is probably found in the saliva. In man there is a variable incubation from three weeks to six months, the period depending largely on the site of the infection. Wounds about the neck and face are especially unfavorable in prognosis; next are those of the hands. Punctured wounds, because of the difficulty of cauterizing them, are most dangerous. Three stages are described. In the *premonitory stage* there is pain, numbness, or irritation about the bite. Irritability, nervousness, and depression are common. In the *stage of excitement* there is great hyperæsthesia. Almost any slight stimulus will cause intense reflex excitability and convulsions. The muscles of deglutition are extremely rigid, or even paralyzed, and any attempt at swallowing may cause spasms of the throat and general convulsions; these may even follow the thought of swallowing. The name hydrophobia is erroneous, and based upon false inferences from these facts. The sufferer from rabies does not fear water—he intensely desires it, as he is devoured with thirst, but he cannot swallow it, nor even "go through the motions" of swallowing. There is also a secretion in the throat and mouth of a thick, viscid mucus, with thickened saliva, and the effort to get rid of this with muscles refusing to act, causes the bark-like cough and hawk so often described as 'barking like a dog.' The patient does not bark, and it is doubtful if he bites. The temperature rises, and the patient may become maniacal. This stage may last from one to four days, and then the *paralytic stage* supervenes. In this stage the spasms stop, unconsciousness supervenes for the first time, the action of the heart ceases, and the patient dies.

The pathological changes found after death from hydrophobia are not characteristic. The most constant are found in the nervous system, especially in the region of the medulla oblongata and pons. The changes consist in a varying degree of inflammation, marked by small round-cell infiltration of the blood-vessel walls, exudation into the pericellular lymph-spaces, small hemorrhages, and sometimes thrombosis of the small blood-vessels. More recently extensive degenerative changes in the nerve-cells have been described. Lesions have also been noted in the sympathetic, consisting in degeneration of the nerve-cells and increase in the thickness of their endothelial capsules. In addition to the changes in the nervous system, there is usually congestion of the mucous membrane of the gastro-intestinal tract and of the pharynx, larynx, and bronchi. Despite the fact that innumerable attempts to discover the cause of the disease have been made without success, it still seems probable that hydrophobia is due to a micro-organism. This organism is not apparently widely distributed throughout the body, but confined mainly to the saliva and the central nervous system. An emulsion made of the medulla of a rabid animal, injected into dogs, cats, rabbits, guinea-pigs, etc., produces symptoms characteristic of the disease, although in rodents there is little or none of the stage of excitement.

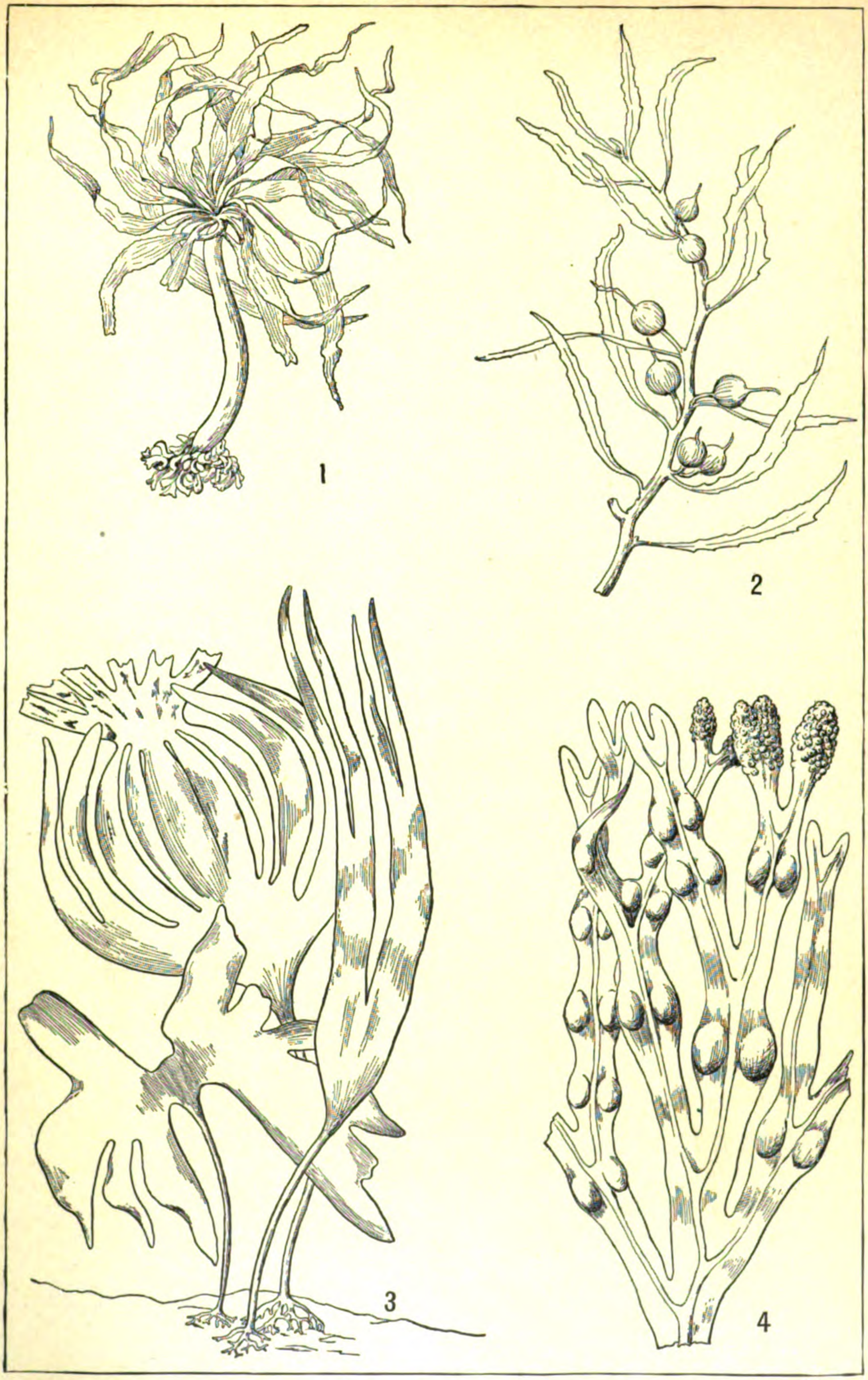
Although we have no knowledge as to the specific germ of the disease, hydrophobia furnishes our most remarkable example of the success of artificial immunization by means of protective inoculation. To the French student Pasteur (q.v.) is due the credit not only of the discovery of the preventive treatment of hydrophobia, but of demonstrating through it a principle in therapeutics which is of constantly widening application. Pasteur found that he could induce the disease in rabbits by inoculations with portions of the spinal cords of rabid animals, and that the spinal cords of these rabbits possessed a high degree of virulence. Drying in air reduced the virulence in direct proportion to the length of the drying. It was found that, while inoculation of man or animals from the fresh rabbit-cords was invariably fatal, if the man or animal was first inoculated from one of the cords the virulence of which had been greatly reduced by the drying, and then from cords of gradually increasing virulence, he could become so accustomed to the virus that injection of the fresh cord would no longer be fatal, and such a series of inoculations made sufficiently soon after the bite of a rabid animal was found to prevent entirely the development of the hydrophobia. Advantage is taken of the long period usually elapsing between the bite and the onset of the disease to practice these preventive inoculations, and the result has been a marked decrease in the mortality from the bites of rabid animals. In view of the uniformly fatal results of hydrophobia and the success of the Pasteur treatment, the importance of determining at the earliest possible moment whether the animal by whom a person has been bitten had rabies can be readily appreciated. The animal should not be killed, for as rabies is invariably fatal to canines, the recovery of a sick animal definitely disproves rabies. On the contrary, the animal should be carefully watched, and if it dies, should be sent to a laboratory where examination can be made and the question of rabies definitely settled by inoculation experiments on animals. The treatment should be cauterization in every case, less than one hour after the bite, by means of the actual cautery, strong acid, or acid nitrate of mercury. Wounds must be opened by the surgeon, and even amputation may be necessary. Washing and syringing wounds with water at 130° F. is desirable. Sucking the wound to draw out the poison has been practiced, and may be safely done if there are no breaks of the membrane of the lips or mouth. Administration of morphine or alcohol does harm. Immunizing by the Pasteur method should be practiced in all cases. By this method the patient is inoculated with attenuated virus by the injection hypodermically of emulsion made from the brain of a rabid animal, repeated in stronger and stronger concentration during twenty-one days. The results of the Pasteur method are now indisputable, but it is of the utmost importance to begin the treatment as soon as possible after the injury, as the prospect of success grows less and less day by day of delay. Following are the results of the antirabic treatment at the Institut Pasteur, Paris, from 1886 through 1899: 21,631 cases were treated, with 99 deaths; showing a mortality of 0.45+ per cent. In 1900 there were thirty-five Pasteur institutes in the world, at the following places: Eight in France, six in Russia, five in Italy, two in Austria, one in New York City, one in Chicago, one in Baltimore, one in Havana, one in Rio Janeiro, one in Buenos Ayres, one in Saragossa, one in Malta, one in Bucharest, one in Constantinople, one in Aleppo, one in Tiflis, one in Algiers, and one in Athens.

PSEUDORABIES, or LYSSOPHOBIA, is a neurasthenic or hysterical condition, in which the patient, who imagines that he has rabies, in his morbid condition of mind enacts some of the symptoms, and may even be frightened to death. Consult: Youatt, *On Canine Madness* (London, 1830); Suzor, *Hydrophobia: An Account of M. Pasteur's System* (London, 1887); Babes, in *Annales de l'Institut Pasteur*, vol. v. (Paris, 1892); Byron, *Researches in the Loomis Laboratory* (New York, 1890); Pasteur, in *Comptes rendus de l'Académie des Sciences* (Paris, 1881 and 1889), and in *Annales de l'Institut Pasteur* (Paris, 1887-88); Salmon, "Development of Knowledge Concerning Animal Diseases," in *U. S. Department of Agriculture, Bureau of Animal Industry, Sixteenth Annual Report* (Washington, 1899).

HY'DROPHYTES (from Gk. ὕδωρ, *hydōr*, water + φυτόν, *phyton*, plant). Plants which grow naturally either in water or in very wet soil. This term is contrasted with mesophytes and xerophytes (qq.v.). Common illustrations of hydrophytic plant societies are swamps of all kinds, pond societies, and ocean plants. Various classes of hydrophytes are taken up under separate heads, where the main features of the various hydrophytic societies will be discussed. It will be desirable, however, to give a short account of the characteristic hydrophytic structures. The roots of hydrophytic plants are in most cases very greatly reduced, and in some cases altogether lost, as in some of the duckweeds. Root-hairs are also commonly lacking in water plants. The stems and leaves are not as a whole conspicuously reduced in water plants, but they show peculiarities of structure that are quite interesting. The leaves of hydrophytes are frequently finely divided, as in the water-milfoil and mermaid-weed. In many cases where the leaves are not finely divided, they are very thin; for example, in tape grass. An examination of the structure of the leaves shows the entire absence of stomata in the submerged parts, complete or almost complete absence of palisade cells, and a very thin epidermis which contains chlorophyll. The stems suffer a noteworthy reduction in the size and development of the water-conducting vessels and mechanical tissues, and a great increase in air-spaces. The structures just described are found in their highest development in submerged water plants. Hydrophytes whose leaves are aërial show no conspicuous differences from ordinary land plants in most respects. One class of hydrophytes, which may perhaps be called amphibious plants, shows some remarkable variations, especially in structure. Leaves which are developed under the water show the characteristic structures outlined above, including the fine leaf division, whereas leaves of the same plant developed in the air show typical aërial leaves without these divisions and with palisades, stomata, and a thick cuticle. The stimulus or stimuli which cause these wide variations are not certainly known, but they are discussed to some extent in the article LEAF. Common American plants, which show variations to a high degree, are the aquatic buttercups, the mermaid-weed, some of the cresses, and water-hemlocks.

However the hydrophytic structures that have been described in the preceding paragraph may have arisen, certain advantages can be clearly seen, at least in some cases. The thin walls of the epidermis, which are in striking contrast to the thick cutinized walls of many aërial leaves, permit the easy entrance of water and substances dissolved in the water. On this account many submerged plants are practically independent of soil relations; they take in most of their material directly from the water. It is easily possible to grow cultures of many of these plants without having any root connection whatsoever. While certain forms, such as the water-milfoil and the water-weed (Elodea), develop roots in ordinary aquarium cultures, other forms, such as hornwort (Ceratophyllum), never develop roots and yet grow quite as vigorously as in their natural rooted condition. A few forms, such as the bladderwort (Utricularia) and some of the duckweeds, have no roots in nature. Of course, in such cases, the entire absorption of nutriment must take place through the leaf epidermis. The fact that the leaf epidermis contains chlorophyll is also a matter of advantage, since water very soon destroys the efficiency of rays of light. At a comparatively shallow depth there is a cessation of the development of green plants. A reduction in the water-conducting tissues, while not necessarily an advantage, is, nevertheless, not harmful, inasmuch as the absorption is so largely through the leaf, instead of the root as in land plants. The reduction in root development is not so easy to understand, since it would seem that holdfast organs would ordinarily be of advantage; then again, any absorption which the roots might make would so much the more increase the capacity of the plant. A high development of air-cavities is a distinct advantage, not only to help float the plant, but probably to a much higher degree to act as a sort of air-storage. It can readily be seen that the conditions for obtaining air underneath the water are not of the best, and that any additional means for obtaining or for storing air would increase the plant's efficiency. The reduction in the development of mechanical tissues, of palisade cells, and of stomata is not necessarily an advantage to water plants, but since these tissues are not actually needed, the plant loses nothing by its failure to develop these structures. The peculiar leaf forms that have been noted above are, perhaps, not necessarily of any exceptional advantage. It must not be supposed that everything in a plant can be explained in accordance with the need of the plant. It is much more likely that the explanations should be referred to definite chemical and physical causes. However, in the case of finely divided leaves, it can be seen that a much larger proportion of cells comes in

HYDROPHYTES



BROWN ALGÆ

1. *Postelsia palmæformis*
2. *Sargassum bacciferum*
3. *Laminaria digitata*
4. *Fucus vesiculosus*

contact with the material than is true with the more compact air leaves. Thus the absorption capacity of the leaf is increased. Finely divided leaves are also doubtless more able to escape the dangers coming from currents of water than leaves which are more compact.

The hydrophytic plant societies are essentially all edaphic, that is, they are conditioned by local causes. In this respect there is a wide contrast as compared with the xerophytic plant societies. Perhaps some of the ocean formations may be conditioned by climatic causes to some extent, but the ordinary hydrophytic societies of swamps and ponds are due to essentially local conditions. Perhaps no plants have such a wide distribution as certain of the hydrophytes. This is particularly true of ocean plants, where it can easily be accounted for by the almost universal distribution of the oceans themselves. It is true, to a striking degree, as well of the pond and swamp plants. Such plants as the pond weeds, cattails, and bulrushes, are found almost throughout the world where the habitats are favorable. Perhaps the chief reason for the wide distribution of hydrophytic species is the great ease of dispersal by means of the water itself, but a reason, almost if not quite as important, is furnished by the wide degree of uniformity of hydrophytic conditions. Since water is colder in summer and warmer in winter than adjoining portions of the land, it is obvious that water plants can, for reasons of temperature, have a much wider distribution than land plants.

The hydrophytic plant societies may be roughly subdivided into those associated with salt water and those with fresh water. The former are treated under the heads PLANKTON; BENTHOS; MANGROVE SWAMP; and HALOPHYTES; the latter under the head of SWAMPS, where it will be convenient, not only to treat the swamps proper, but also, to some extent, the development of the swamps from ponds and lakes. See DISTRIBUTION OF PLANTS.

HYDROSTATIC PRESS. See HYDRAULIC PRESS.

HYDROSTATICS (from Gk. ὕδωρ, *hydōr*, water + στατικός, *statikos*, causing to stand, from ἱστάναι, *histanai*, to stand). That branch of mechanics which treats of the properties of liquids in equilibrium, and of solids either totally or in part immersed in liquids. Many of the laws and phenomena of hydrostatics apply equally well to both liquids and gases, i.e. to fluids. A fluid may be defined to be such a form of matter that it yields to any force, however small, which acts to make one layer of the substance move over another; thus the shape of a liquid or gas depends entirely on the forces acting on it, however small, and not on the body itself, as in the case of a solid. A portion of liquid left to itself—as a falling drop—assumes a spherical shape owing to the contraction of the surface layer. (See CAPILLARITY.) Under the action of gravity a liquid contained in an open vessel takes the shape of the vessel so far as all the surface is concerned, except that portion in contact with the air and the portions near the edges of this 'free surface.' This portion is horizontal, being perpendicular to the vertical force of gravity if the liquid is at rest; because, if it were inclined to this, there would be a component of gravity tending to make the higher portion of the liquid slide down. When a fluid is said to be at rest, it is not implied that there is no motion of the molecules, but simply that there is no *blowing*, i.e. no currents, no wind. In the case of the open vessel, there is a force pressing down on the free surface due to the weight of the atmosphere, and, since the liquid presses against the solid walls, they have a force of reaction against the liquid; thus it is exactly as if the liquid were contained in a vessel and a tight-fitting piston were pressing down on its top surface. If a gas is contained in a balloon or in a room, it expands and is uniformly distributed throughout the space open to it; it presses against the containing walls, and they have an equal reaction on the gas. If a small quantity of a certain liquid is poured into a tall cylindrical vessel, then another liquid with which the first does not mix is poured carefully on top of this, etc.; the equilibrium—if there is any—will be stable only if the density of any one liquid is less than that of the liquid below it and greater than that of the one above it. For, if the density of any layer is greater than that of the one below it, the potential energy of the two will be decreased if the heavier liquid gets to the bottom, and so comes closer to the earth.

FLUID PRESSURE. As a result of the reaction of the containing walls on a liquid or a gas there is always a 'pressure' at each point throughout the fluid, i.e. there is a force acting over any surface immersed in the fluid; the numerical value of the pressure over any area is by definition the force per square centimeter, and the 'pressure at a point' is the limiting value of the force acting on any surface at that point divided by the area of the surface, as the area is supposed to be taken smaller and smaller until it becomes practically a point. This pressure, due to the reaction of the walls, is the same for all points in the fluid. There is also an additional pressure at each point of a fluid on the surface of the earth owing to the fact that any horizontal plane passing through that point has to support the *weight* of the column of fluid vertically above it. If the area of this plane is A; the vertical height above it to the top of the fluid, h; the average density of the fluid, ρ; the acceleration due to gravity of a falling body, g; the upward force will be ρhgA, and, therefore, the pressure is ρgh. These two pressures are the only ones which affect our senses or produce mechanical effects in general; but there is also, of course, at any point in a liquid what may be called 'cohesion,' or pressure due to the action of the molecules on each other. Some idea of the magnitude of this may be obtained by separating the molecules, e.g. by boiling the liquid. It is greatly affected by dissolving substances in the liquid. The pressure against any surface immersed in a fluid at rest is always at right angles to it, otherwise there would be produced a flowing owing to the component of the pressure along the surface. Further, the pressure at any point in a fluid at rest is the same in all directions, because, if it were greater in one direction than in another, the fluid would flow. Therefore the pressure at any point in a fluid at rest is the sum of the pressure due to the reaction of the walls, P, and that due to gravity, ρgh. As noted above, the former is the same for all points in the fluid. As a consequence, if a fluid is inclosed in a cylinder into which fit two pistons of different areas, A_1 and A_2, the forces which must be applied to these pistons from without to prevent the fluid from pressing them outward are PA_1 and PA_2—omitting any action of gravity. Therefore, if A_1 is small compared with A_2, the force on the former piston is small compared with the balancing force on the latter; so a small force may produce a large one. In a liquid which is almost incompressible, P may be very great; and so the force produced may be enormous; but in a gas, which is easily compressed, P is never very large; and so the force produced is small. (This principle is that of the hydrostatic press. See Hydraulic Press.)

The total pressure, i.e. $P + \rho gh$, at all points in the same horizontal level in any one fluid, regardless of the shape or size of the containing vessel, is the same; for imagine a vessel with a horizontal bottom, all points of the fluid along this must have the same pressure, otherwise the fluid would flow; the pressure at any point at a level h centimeters above this bottom plane is less than that at the bottom by an amount ρgh—the same for all points in the plane. If, now, portions of the vessel are imagined removed, so as to leave a vessel of any shape, the pressure at the various points remains unaffected. The pressure on any portion of the containing walls varies with the depth; so the thrust outward on this portion is the resultant of a series of parallel forces, increasing from top to bottom; the point of application of this resultant is called the 'centre of pressure.' If the wall is a vertical rectangle, the centre of the pressure, due to gravity, for a liquid, is at a distance one-third the height from the bottom, etc.

Archimedes's Principle. If a solid is completely immersed in a fluid, the latter exerts on it pressures from all directions perpendicular to the elementary portions of the surface of the solid. These pressures will produce an upward force on the solid equal to the weight of the fluid displaced by it; because, if the space occupied by the solid were to be filled with the fluid, there would be equilibrium; and, as this substitution has not changed the pressures at the boundary surface of the volume formerly occupied by the solid, the resultant of these surface pressures must just balance the weight downward of the fluid. This buoyant force acting on the solid must then equal the weight of the fluid displaced by the solid and must have a vertical line of action passing through the centre of gravity of the displaced fluid. This is called 'Archimedes's principle.' The apparent loss in weight of a body immersed in water, the suspension of a balloon, etc., are illustrations of it. It evidently gives a method for comparing the density of a solid with that of a liquid; for the weight of a solid in a vacuum is ρgv, if ρ is the density of the solid and v its volume; and its apparent loss in weight when weighed suspended in the liquid is $\rho^1 gv$, if ρ^1 is the density of the liquid; both the weight and the loss in weight may be measured, and thus the ratio of ρ and ρ^1 determined.

Free Surface Waves. Liquids differ from gases in having definite volumes; consequently, as noted before, if a liquid is poured into an open vessel, it will have a surface in contact with the atmosphere. This is called the 'free surface.' If the liquid is in equilibrium, this surface must be at right angles to the forces acting on it. Thus a liquid at rest in an open vessel has a horizontal surface owing to the earth's force of gravity. If this surface is disturbed, e.g. by dropping in a stone, the displaced portion will return to its previous level owing to the action of gravity, but its inertia will cause it to continue its motion, making a displacement in the opposite direction; then it will return, etc., thus vibrating up and down and producing waves out over the surface. These gravitational surface waves on a liquid advance with a velocity which depends upon the nature and depth of the liquid and the wave-length of the waves. Thus, if the liquid is shallow compared with the wave-length, the velocity is given by the formula $v = \sqrt{hg}$, where h is the depth of the liquid and g is the acceleration of a falling body. If the liquid is deep compared with the wave-length, the velocity of the waves is

$$v = \sqrt{\frac{g\,\lambda}{2\,\pi}}$$

where λ is the wave-length of any train of waves, and $\pi = 3.1416$. If the waves are extremely short—i.e. ripples—their motion is not due to gravitation, but to capillarity (q.v.), because the surface is increased in area by the ripples; and the capillary forces are, in this case, large compared with the gravitation ones, the surface being so slightly elevated or depressed. The velocity of these capillary waves is

$$v = \sqrt{\frac{2\,\pi\,T}{\lambda\,\rho}}$$

where T is the 'surface-tension' of the liquid. (See Capillarity.) If the vessel containing the liquid is cylindrical, and if this is set rotating rapidly about its axis, the free surface will no longer be horizontal, because now the surface is acted upon by both gravity and 'centrifugal force.' The shape of the surface will be such as to be at right angles to their resultant, and will actually be a paraboloid of revolution.

If a liquid is poured into a vessel which consists of several parts, the liquid will stand at the same height in all parts provided they are wide and open to the atmosphere; for, as has been proved, all points at the same horizontal level in a fluid are at the same pressure, and conversely; and the points in the free surfaces are at the same pressure, viz. that of the atmosphere. If, however, a liquid is poured into a U-tube which stands erect, and then a lighter fluid, which does not mix with the first, is poured into one arm, the level of the surfaces of the liquids in the two arms is not the same. The pressure at points which lie in the horizontal plane passing through the surface of separation of the two liquids must be the same, because they are all connected by one liquid. The pressure at the points in one arm in this level is $\rho_1 gh_1 + P$, where ρ_1 is the density of the liquid in that arm, h_1 is the vertical height of its free surface above the level plane, and P is the pressure of the atmosphere on the free surface; similarly the pressure at this level in the other arm is $\rho_2 gh_2 + P$, where ρ_2 is the density of the liquid whose vertical height from the level to the free surface is h_2. Therefore

$$\rho_1 gh_1 + P = \rho_2 gh_2 + P$$

or

$$\rho_1 h_1 = \rho_2 h_2$$

This principle evidently furnishes a method for the comparison of the densities of two liquids which do not mix.

Flotation. If a body less dense than a liquid is immersed in the liquid and allowed to come to equilibrium, it will rise to the surface and 'float' with only part of its volume below the surface. By Archimedes's principle the upward force equals the weight of the liquid displaced; and, since the body does not move in a vertical direction, this force must equal the weight of the body itself. Therefore, a floating body displaces a volume of the liquid of weight equal to its own. The upward force acts through the centre of gravity of the space formerly occupied by the liquid displaced, while the downward force acts through the centre of gravity of the floating body. If the body is in equilibrium these two forces must have the same line of action, or the two centres of gravity must lie in the same vertical line. In most cases this equilibrium is stable, but it may be unstable, e.g. an oblong block set floating with its long direction vertical. The test of stability is to give the floating body a small displacement, i.e. tip it slightly, and to see if the forces acting on it tend to restore it to its previous position or to make it tip still further. See Metacentre.

Capillarity. Where the free surface of the liquid meets the wall it is not horizontal; and, when a tube of fine bore dips into a liquid, the free surface inside the tube is at a different level from that outside. These variations are said to be due to capillary action, and they may all be shown to be due to the fact that a liquid surface contracts so as to have the smallest area compatible with existing conditions.

The principle of Archimedes, discussed above, is attributed correctly to the philosopher of Syracuse; and many facts in regard to liquids were known to him and other scientists of antiquity. Galileo first stated the law of connecting tubes, and Pascal was the first to recognize the fact that the reaction of the walls produced a pressure which was the same at all points throughout the fluid. The ordinary statements and proofs of hydrostatics are given today exactly as they were by Stevinus (1548-1620). For further information, consult Greenhill, *Hydrostatics* (London, 1894).

HY'DROSULPHU'RIC ACID. See Sulphureted Hydrogen.

HY'DROTHER'APY, or **HYDROP'ATHY** (from Gk. ὕδωρ, *hydōr*, water + θεραπεία, *therapeia*, cure, from θεραπεύειν, *therapeuein*, to cure, from θεράπων, *therapōn*, attendant). Water treatment. The efficacy of water in the cure of numerous forms of disease has long been recognized. Water was largely employed by Hippocrates in the treatment of many kinds of disease. Horace speaks of Antonius Musa, the hydropathic physician of the Emperor Augustus (Epist. i. 15). Both Celsus and Galen speak favorably in their writings of the use of water in the cure of disease, regarding it as of high value in the treatment of acute complaints, particularly of fevers. Throughout the Middle Ages, likewise, many physicians, including Aëtius, Paulus Ægineta, and Paracelsus, were advocates of the remedial virtues of water; all of them, however, having faith in its uses in the treatment rather of acute than of chronic disorders. In 1723 Niccolò Lanzani, a Neapolitan physician, published a learned treatise on the subject. In England, about the beginning of the eighteenth century, Sir John Floyer and Dr. Baynard made large use of water. Their conjoint work, denominated *Psychrolousia*, or the "History of Cold Bathing, both Ancient and Modern," is replete with quaint learning and practical shrewdness and sagacity. But the most able and scientific among the older treatises that have appeared in England on the subject of the water treatment is the work of Dr. Currie, published in 1797, entitled *Medical Reports on the Effects of Water, Cold and Warm,* etc. In this work Currie recommends the cold affusion in typhus and other fevers, and gives practical directions in regard to the cases and the times when it may be used with advantage, although he appears to have limited his use of water to acute ailments exclusively.

We have thus seen that up to the beginning of the nineteenth century, by some of those who employed it as a curative agent, water was used in the treatment of acute, and by others of chronic, diseases; by some as an internal agent alone; by others as an external application in the various forms of the bath; but never in all the manners combined. This combination was first effected by the original genius of Vincent Priessnitz, a Silesian farmer, with whom began a new era for the water cure. It was owing, we are told, to his successful treatment of more than one bodily injury which he had sustained in his own person that, about the year 1820, Priessnitz became so convinced of the curative powers of water as to employ it medically in the cure of others. Beginning with the external application of water for trifling diseases among the poor of his neighborhood, he gradually undertook an extended range of cases, and multiplied the modes of administration, introducing the wet compress, the douche bath, partial baths of all kinds, the sweating process, the wet sheet, together with copious drinking of pure water. In addition to water in all these forms, he insisted on the value of exercise, diet, fresh air, and mental repose in the cure of disease, thus practically calling to his aid the entire resources of hygiene, and establishing by a simple, yet thoroughly original combination, nothing less than a new system of medical treatment. As to the success which attended Priessnitz's practice, it is an historical fact that of 7500 patients who had gone to Gräfenberg for advice and treatment up to the year 1841, or within the space of about twenty years, there had been only 39 deaths. It is to be regretted, however, that the founder of the new system was not himself an educated physician, so that he could have understood better the philosophy of his own practice and explained it more correctly. He would not have called his system the 'water cure,' a name scientifically one-sided and incomplete, and therefore misleading.

The undoubted merits of hydropathy at length called to its defense many men of standing in the profession, who, allowing for some of its early extravagances, explained it scientifically, and from their advocacy has sprung up a school of hydropathic physicians. Dr. Winternitz, of Germany, in 1883 laid down the scientific principles of modern hydrotherapy. The fundamental principles of hydrotherapy are very simple. The art of applying these principles requires much teaching, but any one with even moderate sense and intellect can grasp the essential features. Water may be used either internally or externally. Internally it may be used simply to wash out a cavity—the nose, the mouth, the stomach, the bladder, or the rectum. In addition, it may be taken internally hot or cold and passed into the blood. It may be used hot in the rectum, as a simple enema, or for purposes of stimulation. Externally, water may be used in many conceivable ways, but essentially the use of water means with it the use of two very necessary aids, heat and cold. Hydrotherapy, apart from the use of heat and cold, is of secondary importance. The action of water in the treatment of disease is therefore largely mechanical. The psychical side is not unimportant. It has been used by enlightened physicians ever since the dawn of medicine, and its effects taught in all medical schools. Only the quack and the charlatan will claim that hydrotherapy is a cure-all. Eccentricities, like the Kneipp cure and others, are to be avoided by the sensible. Water acts physically and mechanically. It is capable of readily taking up heat and of giving it up; it thus lends itself most readily to the use of thermal agents. It may be used in gaseous form (steam), liquid form, or solid form (ice). The action of heat and cold is essentially important. Smooth muscle-fibre expands under the action of moderate heat and contracts under the influence of cold. Its contracting power may be destroyed by an excess of either. Cold and heat, therefore, act as irritants to the nervous system, and through their agency we can act upon all of the organs, to stimulate or depress their activities. The heart, lungs, kidneys, liver, spleen, skin, etc., may all be influenced; the body heat and the output of moisture and secretions may be regulated. Thus by the use of heat or cold to certain portions of the skin or internally, almost every organ in the body can be influenced through its blood-vessels, and the skilled physician can, by guiding and directing these effects, bring about changes in vascular states; can remove excess of blood from one part of the body and bring it to another; can impart tone to a flagging organ, as the heart, or to the muscles or to the spinal cord; can increase the secretions from organs, such as the skin or the kidneys, and thus assist in excreting poisonous products from the body.

The applications of water to disease are well systematized by Baruch as *ablution*, *affusion*, *sheet bath*, *drip sheet*, *compresses*, *wet pack*, *tub bath*, and *douche*.

Ablution. Simple application of water by the hand or moist cloth over the body. In fevers the abdomen, the back, the chest, the lower extremities as far as the knees are bathed successively every two or three hours. A temperature of 75° F. should be used at first, and gradually reduced to 60° F. Chilling is to be avoided. Reaction is to be gained, the superficial capillaries becoming suffused and the body assuming a pinkish hue. Rubbing should always be used in ablutions.

Affusion. The patient, with a cold wet cloth about the head, sits or stands in a tub containing about a foot of water at 100° F. A broad stream of water from a bucket or pitcher is poured with force directly over the body. The stimulation will depend upon the temperature of the water and its force of delivery. This is often used in states of profound prostration, in coma, and in stuporous, delirious states.

Sheet Bath. A rubber sheet is laid down over one-half of the bed. This is covered by a blanket. Then a linen sheet is dipped in water at a temperature of from 60 to 70° F., and while still wet is wrapped about the patient while he lies upon the blanket. The face is bathed in ice-water and the head covered with a wet towel. The nurse or attendant rubs the patient energetically over the body. As the body reacts and becomes warm, water at still lower temperatures may be sprayed over the sheet. Afterwards the patient may lie wrapped up in the blanket. This is an excellent method for reducing temperature in fevers, and is applicable in practically all acute diseases accompanied by high temperature.

Drip Sheet. The patient, standing in a tub of water at 100° F., has a wet sheet, wrung out, wrapped about him. He is then firmly rubbed until a reaction occurs. He may be slapped gently instead of being rubbed. This procedure forms an excellent tonic in nervous exhaustion, in the early stages of tuberculosis, and in chlorosis or anæmia.

Compresses. These consist of bands or squares of old linen to which flannel is attached and strings made to fasten the appliance about a part. The linen piece is usually wrung out of hot or cold water and applied to the part and wrapped about by the flannel to prevent evaporation. These compresses are valuable in sore throat, tonsilitis, rheumatism, pneumonia, sprains, etc. They should be renewed hourly in acute processes.

Wet Pack. This is similar to the sheet bath, save that the sheet covering the body is wrung dry and then the patient is rolled up completely in thick blankets. The air should be kept out by fixing the blanket very securely about the feet and neck. The wet pack is more useful in chronic cases. Friction is essential in the acute cases, in order to bring about quicker reaction; hence in these the sheet bath is usually preferred to the wet pack.

Tub Bath. A trained nurse should give this bath. See Typhoid Fever.

Douche. This apparatus throws a jet of water against the body from a hose, and is best given in a special institution devised for this work. Arrangement is made in the apparatus whereby the force of the jet and its temperature can be regulated.

Consult Baruch, *Principles and Practice of Hydrotherapy* (New York, 1900). See Bath; Typhoid Fever.

HY'DROTHO'RAX (Neo-Lat., from Gk. ὕδωρ, *hydōr*, water + θώραξ, *thōrax*, chest). The term applied to dropsical collections in the pleura (q.v.), a closed serous sac enveloping the lung on either side. When it exists to any extent, the pressure which it exerts on the lungs impedes the passage of the blood through them, and occasions difficulty of breathing, lividity of countenance, etc., and more or less dropsy in the face, ankles, etc., soon appears. The physical signs by which the disease can be detected are changes in the condition of the chest, as ascertained by auscultation, percussion, and succussion by the physician.

Hydrothorax may depend upon inflammation of the secreting membrane, or it may be a consequence of organic disease of the heart or lungs, liver, or kidneys. With regard to treatment, when the disease seems to depend upon inflammation of the pleura, great advantage may often be derived from occasional cupping and repeated blistering, hydragogue catharsis, tapping of an ascitic abdomen, etc., according to the cause.

HYDROT'ROPISM (from Gk. ὕδωρ, *hydōr*, water + τροπή, *tropē*, a turning, from τρέπειν, *trepein*, to turn). The sensitiveness of certain plant organs to the presence of unequal moisture, which causes them to curve toward the source of moisture. Among the fungi hydrotropism is shown particularly by those filaments (hyphæ) which bear the sporangia. While most of the hyphæ ramify through the moist substance on which the fungus grows, the sporangial hyphæ rise at right angles to it. If they start from a salient angle on the substratum (e.g. the edge of a slice of bread), they may take the position shown at Fig. 1, growing equidistant from the two moist surfaces. If they arise from a reentrant angle, they place themselves likewise so as to be as far away from each moist surface as possible. The roots of higher plants are also sensitive to moisture, the stimulus of which may exceed that of gravity, as shown in Fig. 2. Here roots of corn planted in the heaped-up sand have come over the edge of the glass funnel, and have started to grow downward in the moist air. As they get farther from the surface of the wet paper covering the outside of the funnel, they find drier and drier air. A stream of water particles, however, is reaching them from one side. At a certain point the stimulus of the diffusing moisture overcomes the geotropism (q.v.) and the root, growing more rapidly on one side, is directed toward the moist surface. When it comes into the neighborhood of the moist paper again the sides are less unequally stimulated, the stimulus of gravity reasserts itself, and the tip again grows downward. The alternating prevalence of hydrotropism and geotropism is shown in the wavy course of the longer roots. It will be observed that the more rapid growth which directs the tip toward the moist surface is not due merely to the absorption of water, for it occurs on the drier side of the root. Hydrotropism is a form of chemotropism (q.v.).

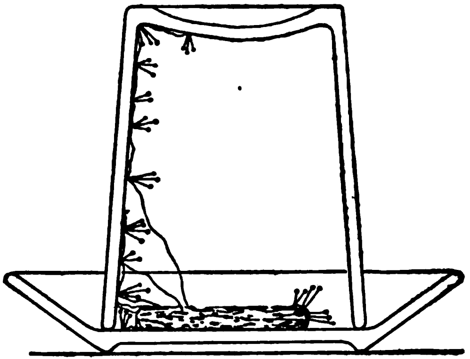


FIG. 1. NEGATIVE HYDROTROPISM.

Culture of the black mold on bread in a moist chamber. The hyphæ carrying the thread-like sporangia grown in such directions as to be as far as possible from the surfaces of bread and glass from which moisture is diffusing. Diagrammatic.

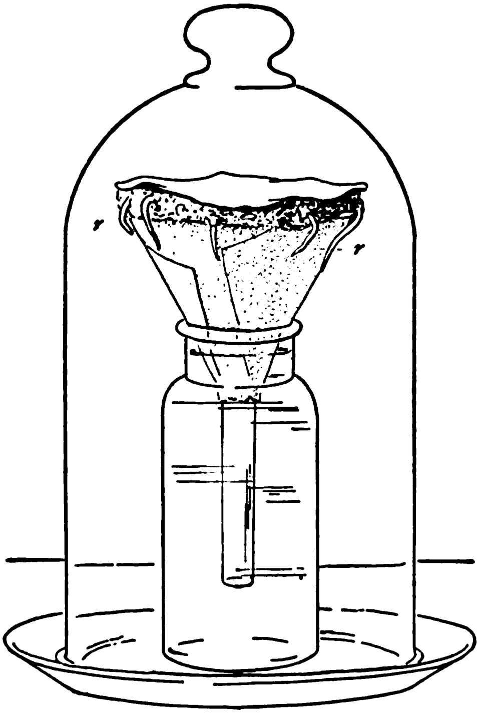


FIG. 2. POSITIVE HYDROTROPISM.

Grains of corn, planted in wet sand in a funnel whose outer surface is covered with wet blotting-paper, have germinated. The roots, r, instead of growing straight down, as they would do in saturated air, have applied themselves to the wet paper. Hydrotropism under these conditions overpowers geotropism.

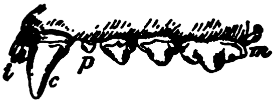
HY'DROZO'A (Neo-Lat. nom. pl., from Gk. ὕδωρ, *hydōr*, water + ζῷον, *zōon*, animal). A class of Cœlenterata in which the simplest form of the body, as in the polyps, is a sac attached by its posterior end, and with a digestive cavity communicating with the exterior by a mouth only. The mouth is surrounded by hollow tentacles. The body is composed of two cellular layers, the ectoderm and endoderm, separated by a gelatinous, non-cellular 'mesoglœa.' The body is usually differentiated into two sorts of zooids, i.e. 'polyps' or nutritive zoöids, which are usually sexless, and 'medusæ,' or reproductive zoöids. The latter produce medusa buds, which on being set free are called medusæ, and are bisexual. In these medusæ the body is greatly more complicated than in the polyps, being bell or umbrella shaped, with a well-developed nervous system, composed of a thread-ring around the eye of the disk and with ganglia near the 'eyes' or sense organs. The digestive cavity is differentiated into a central and a peripheral portion, the latter forming radial and circular canals. The eggs and sperm are discharged externally, and fertilization of the egg takes place in the sea. Nettling organs (see NEMATOCYST) are usually present; they arise from some of the interstitial cells, and are most abundant in the tentacles. Many Hydrozoa (Hydra and Hydractinia excepted) exhibit the phenomenon of alternation of generations (q.v.). The asexual polyps give rise to buds which develop into medusæ, and the latter lay the eggs from which are hatched the polyps. The medusæ are more or less phosphorescent. They abound in all seas, while Hydra is a minute fresh-water form. Very primitive fresh-water forms are Protohydra and Microhydra, which are without tentacles.

The Hydrozoa are grouped in six orders: (1) *Leptolinæ*, having a fixed zoöphyte or polyp stage, and the sense organs exclusively ectodermal (Anthomedusæ and Leptomedusæ); (2) *Trachylinæ*, having no fixed zoöphyte stage, all being locomotive medusæ (Trachymedusæ and Narcomedusæ); (3) *Hydracorallina*, coral-making polyps (Millepora and Stylaster); (4) *Siphonophora*, pelagic hydrozoans in polymorphic colonies; (5) *Graptolithoidea*, an extinct Paleozoic group, related to (6) the *Hydromedusæ*. The Hydromedusæ are a very heterogeneous assemblage of polyp and medusa forms, arranged in several families. In some species we find only hydroids, in others only medusæ; but in many the hydroids and medusæ are alternate generations of a common stock.

Of the orders above mentioned, the Hydrocorallina and Graptolithoidea are of importance to the geologist, for they contain fossils of considerable interest. (See STROMATOPORA, and GRAPTOLITE.) Fossil representatives of the Scyphomedusæ are rare, but have been described from Cambrian, Jurassic, and other formations.

Consult: Parker and Haswell, *Text-Book of Zoölogy* (London and New York, 1897); Huxley, *The Oceanic Hydrozoa* (London, 1859); Fowler, "The Hydromedusidæ and the Scyphomedusidæ," in Lankester's *Treatise on Zoölogy*, part ii. (London, 1900). See CORAL; CTENOPHORA; HYDRA; HYDROID; JELLYFISH; MEDUSÆ; POLYP; SIPHONOPHORA; etc.

HYENA, hī-ē'nȧ (Lat. *hyæna*, from Gk. *ὕαινα*, *hyaina*, hyena, from *ὗς*, *hys*, hog, Lat. *sus*, AS., OHG. *sū*, Ger. *Sau*, Eng. *sow*, Av. *hu*, pig; connected either with Skt. *sū*, to bear, or with Skt. *sūkara*, swine, *sū*, maker, so called from the grunt). One of a family (Hyænidæ) of carnivorous animals remarkable for their generalized structure, which unites features characteristic of the cats, the civets, and the dogs. Their dentition is calculated for great tearing and crushing power, and includes six incisors and two canine teeth in each jaw, five molars on each side of the upper jaw, and four in the under. This dentition and other features place them between the dogs and the civets, with the latter of which they are connected by Proteles. (See AARD-WOLF.) They seize an object with so firm a hold that among Arabs they are proverbial for obstinacy. The vertebræ of the neck sometimes become anchylosed in old hyenas. In size they equal the largest dogs. The hind quarters are lower and weaker than the fore quarters of the body, so that hyenas move with a shambling gait. The body is covered with long coarse hair, forming a mane along the neck and back. The feet have each four toes. The claws are strong, fit for digging, and not retractile. The tail is short. Beneath the anus is a deep glandular pouch, contributing much to the offensive odor which is one of their many disagreeable characteristics. Hyenas eat carrion as well as newly killed prey, and are of much use, like vultures, as scavengers, clearing away the last remnants of carcasses. They sometimes attack cattle, especially if they flee, but rarely man, though they sometimes seize children. Selous gives surprising instances of their boldness and strength in East Africa. During the day they hide themselves in caves, old rock tombs, and ruined edifices; by night they roam singly or in packs. They prowl about towns and villages, and often dig up corpses that have not been deeply buried. This, together with their aspect and manners, has caused them to be generally regarded with horror, and very exaggerated accounts of their fierceness have been prevalent. Instead of being untamable, as was long the popular belief, they are capable of being completely tamed, and show an attachment to man similar to that of the dog; they have even been used as watch-dogs. Hyenas are found only in Africa and in South-central Asia.



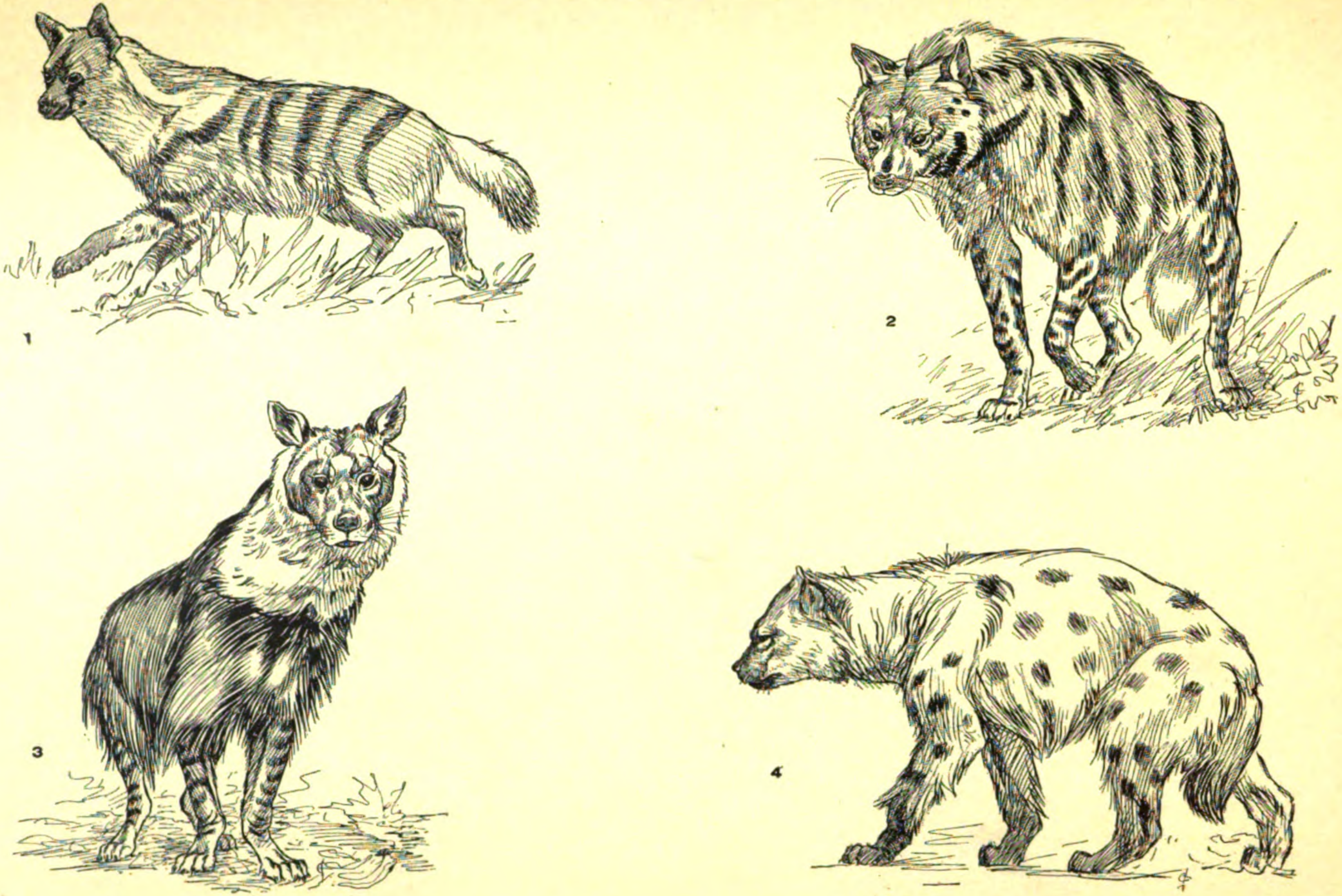
DENTITION OF HYENA.
i, incisors; *c*, canine; *p*, premolars; *m*, molars.

The most typical and at the same time familiar form is the striped hyena (*Hyæna striata*), which ranges from Abyssinia and the Libyan Desert eastward to India, where it is common throughout all the more open country, roaming widely at night in search of carrion, or living sheep and dogs. It is dirty gray, with narrow tawny or zebra-like stripes, a coarse mane along the back, and a bushy tail. It is cowardly, silent, and both hated and feared by the rural people. Two other species are exclusively African, and differ much from the striped, so that some naturalists put them in another genus (Crocuta). The spotted hyena (*Hyæna crocuta*) is larger than either the striped or the brown, and is yellowish, thickly spotted with black, with nose and feet dark. It inhabits nearly all Africa south of the Sahara, hunts in packs, is courageous, and really does most of the ravaging it is accused of. Its unearthly coughing cry is one of the most terrifying of animal utterances. Owing to the peculiar arrangement of the reproductive organs in this species, it is extremely difficult, except by careful examination, to distinguish the sexes by external characters, and from this fact the old myth that hyenas are hermaphrodites has doubtless arisen.

Median in size stands the brown hyena (*Hyæna brunnea*), found on both sides of southern Africa near the coast, and often on the mountains. It is a less repulsive looking animal than the others; has a dog-like mantle of long brown hair which half conceals its barred legs, and becomes white on the sides of the head and chest, giving a quaint appearance to the front view, since the face itself is black, while the tall ears are gray.

The hyena family, of comparatively recent origin, appears to have evolved from the Viverridæ, through such intermediate genus as Ictitherium of the Lower Pliocene of Southern Europe. That Ictitherium ate bones in the same manner as do the modern hyenas has been proved by the nature of the coprolites found associated with their skeletons. True hyenas are common fossils in the Pliocene and Pleistocene deposits of Europe, during which periods they roamed in abundance as far north as France and England, as is exhibited by their remains in cave floors; and they are known in deposits of similar age in Asia. None have been found in America.

HYENAS AND PROTELES



1. AARD-WOLF (Proteles lalandi).
2. STRIPED HYENA (Hyæna striata).

3. BROWN HYENA (Hyæna brunnea).
4. SPOTTED HYENA (Hyæna crocuta).

Consult: Blanford, *Fauna of British India: Mammals* (London, 1888-91); *Zoölogy of Abyssinia* (London, 1870); and the writings of sportsmen-travelers in Africa and India. See Plate of HYENAS.

HYENA DOG. See HUNTING DOG.

HYÈRES, ē'âr'. A town in the Department of Var, France, three miles from the Mediterranean and eight miles east of Toulon (Map: France, N 8). It is a fashionable winter resort picturesquely situated on the southern slope of a castle-crowned hill 670 feet high, in a district noted for its mild climate, sheltered location, and luxuriant vegetation. Its chief buildings are the restored twelfth-century cathedral Church of Saint Louis, the hôtel de ville, public library, and museum. There is a considerable export trade in flowers, fruits, cork, and salt, the extensive salt marshes in the vicinity yielding over 20,000 tons annually. The neighborhood has the remains of a Roman town. In mediæval times, as Hiedera, Hyères was a favored port of call for Oriental pilgrims, and as late as the fourteenth century was of greater importance than Toulon. Population, in 1901, 17,659.

HYGEIA, hī-gē'yȧ (Lat., from Gk. Ὑγίεια, *Hygieia*, Ὑγεία, *Hygeia*, health, from ὑγιής, *hygiēs*, healthful; connected with Skt. *ugra*, mighty). In the ordinary tradition, the goddess of health, daughter of Asclepius, and honored with him at Athens, Epidaurus, Sicyon, Corinth, Titane, and elsewhere. She was joined with the god of healing, Amphiaraus, at Oropus, and on the Acropolis at Athens was an ancient cult of Athena Hygeia, to whom a statue and altar were erected after the great plague, and before the introduction of the worship of Asclepius in Athens. In the art of the fifth and fourth centuries B.C., Hygeia is represented as a maiden, but of the fully developed and vigorous type, while later her form is more youthful and girlish. She is represented in company with her father, or sometimes alone, with the snake by her side or drinking from the patera in her hand. Hygeia seems to be an originally independent divinity, but later came into connection with various deities who had become associated with the cure of disease.

HYGIENE, hī'jĭ-ēn (from Fr. *hygiène*, from Gk. ὑγιαίνειν, *hygiainein*, to be healthy, from ὑγιής, *hygiēs*, healthy). The branch of medical science which deals with the preservation of health. Within its scope are all measures taken for the acquisition and preservation of health, except those involving purely medical and surgical means. Hygienic measures were a part of religious observance among the Jews, as well as among the people of Assyria and India, and their enforcement lay with the priests. Among the Greeks these duties were transferred to the physicians. Hippocrates's work on *Air, Water, and Places* was largely responsible for this change. (See HIPPOCRATES.) In the twenty-second book of Homer's *Odyssey* there is an account of the sanitary precautions taken by Ulysses after the killing of the wooers. The place of slaughter was cleansed and disinfected by scraping and washing, and by burning sulphur. Little attention appears to have been paid to the infected individual in the olden time, when the panic ensuing upon a plague caused expulsion or expatriation of the sufferers. Laws were framed to protect the public from lepers, for example, by expelling them and burning their houses. In 1423 Venice established its first lazaretto, and in 1485 a permanent health magistracy was created in that city. In 1532 an act of Parliament authorized in England the issue of commissions of sewers for "the overlooking of sea banks and sea walls, and the cleansing of rivers, public streams, and ditches." In 1552 Shakespeare's father was fined for throwing filth into the street, and again in 1558 for not keeping his gutter clean.

Roman law provided no protection for the individual. Greek and Latin writers treated of diet and exercise for the patrons of literature, for princes, and for the wealthy. From the school of Salernum, about the twelfth century, issued the *Code of Health*, which was printed in 1480, and for two centuries thereafter remained the standard work on personal hygiene. Despite the stringent laws seeking to prevent plague which were enacted by James I., and the establishment of lazarettos into which ships discharged their cargoes for detention and airing, serious outbreaks of the dread disease occurred in 1625 and 1629-31. In 1665, according to Macaulay's estimate, the number of deaths from plague during one period of six months reached more than 100,000.

At the close of the eighteenth century little advance had been made in hygienic knowledge beyond the discovery by Woodhall, in 1617, that scurvy was prevented by the use of lemon-juice; the discovery by Morton, in 1697, that foul air produced disease in some way; and the introduction from China into England in 1717 of inoculation with smallpox virus by Lady Mary Wortley Montagu. Differentiation of fevers began early in the nineteenth century. Following the cholera epidemic in London of 1831-32, newly awakened interest resulted in the formation in 1838 of a system of registration of deaths in that city. The establishment of the fact of water-borne diseases was made by the investigations of Dr. John Snow into the cholera outbreak in London, in 1848-49. From this date investigation has been systematically pursued into the causes of death; the causes of disease, its spread, and the agencies that produce it; and into the conditions that promote health. The use of the microscope, the study of bacteriology, of pathology, of the chemistry of food, of climate, and of exercise have all added to the knowledge that has increased the useful application of hygienic principles in our day. Sanitary laws have been enacted which control unhealthful agencies and aim to safeguard and regulate commercial as well as domestic relations.

Hygiene may be variously classified, according to its relations, and the objects in view. There is the hygiene of the individual, of the family, and of the municipality or State; which may be denominated personal, domestic, and public hygiene.

PERSONAL HYGIENE. This includes the study of (1) *Food*, including water and beverages. Food should be adapted to the season of the year, the age, occupation, and the condition of health of the individual. An increase in the quantity of fruit and of water, a greater proportion of vegetables, and smaller meals are desirable in hot weather, while an increase in meat and in cereals is desirable in cold weather. Infants require principally milk, with the proportions of proteids, fats, and sugar graded according to age and digestive capacity. Older children require small quantities of meats, cereals, fruits, and vegetables. In regard to occupation, it may be said in general that active laboring men, like carpenters, wheelwrights, and farmers, may partake of food which takes a considerable time to digest, with more advantage than sedentary men may. Pork and corn-cake or bread is a nutritious and sustaining diet to an active laborer, but should not form the habitual diet of a sedentary person. (See DIET, paragraph *Diet in Disease;* see also FOOD.) The investigation of water-supply, examination for noxious ingredients or medicinal properties in drinking-water, as well as directions for its use, come within the province of hygiene, as does also the use of coffee and tea, which are both stimulating drugs, causing in some persons overaction of the heart, cerebral activity resulting in insomnia, and indigestion; of cocoa, which is slightly stimulating, but contains food; of wine, beer, and distilled liquors, all of which are drugs in the eyes of the physician and the sanitarian, to be used with accurate calculation of their nutrient and stimulant properties. (See ALCOHOL, PHYSIOLOGICAL AND POISONOUS ACTION OF.) (2) *Clothing* should be suited to the temperature, age, and occupation. Ventilation as well as materials—wool, cotton, linen, and silk—must be considered. (3) *Work and Exercise* are necessary for every one. Regular physical activity is essential to proper development, and to the maintenance of normal action of the vital organs, and the repair of tissue. Even those who are confined to bed by disease need exercise, which is secured by passive motion or massage. (See GYMNASTICS; EXERCISE; MASSAGE.) To work must be joined the consideration of rest and sleep, which should be enjoyed at regular intervals, and in quantities proportioned to individual conditions and occupations. (See SLEEP.) (4) *Personal Cleanliness* includes regular evacuations of the bowels daily; daily bathing, securing constant removal of perspiration; care of the hair and scalp, and care of the nostrils, of the cavity of the mouth and teeth, of the genitals, and of the anal orifice. (5) *Special Habits* which tend to undermine health should be controlled; the use of tobacco, of other narcotics, and of stimulants should receive consideration. Tobacco should never be used before the age of twenty-one or twenty-two years has been reached, and should rarely be used by neurasthenics. In certain diseases, as Bright's disease and syphilis, and certain conditions of the heart, tobacco is pernicious. All other narcotics are distinctly deleterious, and should be forbidden. (6) *Control of Sexual and Other Passions* has much to do with personal health. Indulgence in masturbation by the young delays development, and in a vast majority of cases causes mental enfeeblement. Excessive sexual intercourse has a similar effect, with greater disaster to the male. Perhaps the most undermining of normal mental activities are anger and grief, and these should be avoided or limited. The thoughts should be calm, and mental exercise, as well as physical, should be regularly taken. Mental indolence leads more often to mental disorder than does mental overwork.

DOMESTIC HYGIENE. This includes the study of (1) *The Management of Infancy,* (2) *Preparation of Food,* with regulation of meals, as well as supervision of cooking, and (3) the *Hygiene of the Sick-Room,* including removal of dust-catching furnishings, regulation of heat, light, and ventilation, provision of utensils which may be sterilized, care of bedding and bed-linen, and arrangements for proper bathing and nursing. Besides these subdivisions, others might be made which would duplicate some of the titles more properly assigned to personal or public hygiene; such as *air,* and *hygiene of the school.*

PUBLIC HYGIENE. This comprises care of the surroundings of man, as well as prevention of disease, and disposal of the dead; and therefore includes a consideration of: (1) *Climate,* as one of the agencies active in man's environment, is used as an elastic term to embrace the range of temperature of a locality, the prevailing winds, the rainfall, the vegetation, and the soil. (2) the *Soil under Dwellings,* with reference to possibilities of drainage-proximity to underground water, etc. (3) The *Character of Dwellings,* especially tenements, as to ventilation, and air-space, position, and materials used in construction, and provision for regulating temperature, water-supply and drainage. (4) *Cleansing of Dwellings* and *Disposal of Refuse.* (5) *Cleansing of Streets* in towns. One of the most important questions of public hygiene is the cleaning of streets, and matters connected therewith. Filthy streets are productive of disease not only by the generation of poisonous gases, but also the dust which results from the long-continued trituration of excrementitious and decaying substances is extremely injurious to the mucous membrane of the air-passages, and productive of contamination to blood and tissue. The habit of casting the sweepings of houses and stores upon the sidewalks, especially during the hours in which pedestrians are passing, is a greater evil than many suppose. The dust of these places is often of the most objectionable character, containing the germs of contagion, and there is no doubt that many 'filth diseases' (q.v.) are propagated in this manner. (6) *Regulation of Public Conveyances.* Public conveyances are frequent causes of disease from various sources. The dust which is allowed to collect in street cars, and also ordinary steam railway cars, is of itself a frequent cause of diseases of the air-passages; but compared to the evils which result from overcrowding and bad ventilation, it is of minor importance. Pneumonia, pleurisy, bronchitis, and laryngitis are frequent results of street-car exposure. But one of their greatest evils, and one not yet sufficiently recognized by the public, although well known to the medical profession, is the want of attention paid to the smoothness of the track and the springs of the cars. On street cars undue jarring should not be permitted. When they are properly supplied with springs, and when wheels that are flattened are promptly replaced, all injurious vibrations will be avoided. (7) *Control of Air-spaces in Public Buildings,* such as hospitals, asylums, orphanages, lecture-rooms, theatres, school-houses, etc. The vitiation of air due to impurities added to it by respiration is a subject of great moment. Following are figures showing the difference in the proportion of the constituents of the percentages of expired air and of ordinary air:

	Ordinary air	Expired air
Oxygen	20.96	16.40
Nitrogen	79.00	79.19
Carbon dioxide	0.04	4.41

From these figures it is seen that expired air contains over one hundred times more carbon dioxide and nearly 5 per cent. less oxygen than ordinary atmospheric air. Experiments have shown that the average adult emits with each expiration 22 cubic inches of air; or, assuming 18 respirations a minute, 570,240 cubic inches or 330 cubic feet of air in 24 hours. In this total of expired air there is 14.52 cubic feet of carbon dioxide. This amount is increased with increase of physical activity. The figures of De Chaumont, which are generally accepted, show that there is 0.6 part of carbon dioxide per 1000 in the air of a closed and occupied space, or 0.2 part in excess of that in ordinary atmosphere. Burning of coal or illuminating gas adds to the impurity, and hence ventilation is essential. In public buildings, such as those named, there should be three cubic feet of space per person in each room, after deducting from the total room-space the amount occupied by furniture and the bodies of the persons. (8) *Prevention of Disease.* This is a very large topic, and necessarily bears close relation with personal as well as domestic hygiene. It includes notification of diseases to a health officer; most of the activities of municipal departments of health (see Health, Boards of); control of streets and houses, and disposal of refuse (see Disinfectants); control of disease entering our ports (see Quarantine); prophylaxis of special kinds against spread of disease (see Antitoxin; Serum Therapy; Vaccination); cleansing of public vehicles, to which reference has been made, etc. Overcrowded and dark tenements are the most frequent causes of the spread of disease in a community. They keep alive the diseases of childhood—measles, scarlet fever, diphtheria, etc.—and are the most frequent hiding-places for the germs of tuberculosis. (9) *Disposal of the Dead* is regulated by sanitary laws, which provide, in cities, that undertakers shall obtain permits for removal of dead bodies, and proper disposition shall be made of them by burial or cremation. Public funerals in the case of contagious diseases are often forbidden, and hermetically sealed caskets are enjoined in such cases by many municipalities.

Mental and Physical Hygiene. To regard the matter from another view-point, hygiene may be also divided into mental and physical. The former will necessarily include many questions that belong to the latter, for the healthy action of the mind depends to a great extent upon the health of the body. A sufficient amount of sleep ought to be taken to refresh the powers of the mind, as well as those of the body, and that sleep ought not to be much disturbed by dreams. Of course there are those whose occupation demands varied, sometimes excessive exertion, and who must be 'a law unto themselves.' The great time for practically applying the laws of mental hygiene is during the years of childhood and youth. The method of teaching the child should be of the simplest, as well as of the most comprehensive character, and the periods should be frequent during which its mind is completely relieved of all serious study, and allowed to come to a perfectly natural and passive condition by mirthful and affectionate enjoyment. The schoolrooms should be commodious, and well ventilated, and they should not be overcrowded. Too many studies should not be required, so that hours which should be given to recreation or sleep will not be occupied with laborious efforts of study, which often do little more than produce a disturbed and unrefreshing sleep, and pervert or destroy the appetite for wholesome food. In the matter of school hygiene, great importance is attached to the amount, arrangement, and distribution of light in the class-rooms; the construction of the seats and desks; the type and paper used in making the text-books, etc. Carelessness in these matters is known to be one of the most fruitful sources of imperfect sight, such as myopia, as well as of various deformities, especially spinal curvature.

Military Hygiene. This term is applied to the sanitary care of the soldier in camp and garrison, and while on the field. Military hygiene embraces a consideration of: (1) *The Selection of the Recruit,* his exercise and training, his general development, and his mental and moral education. (2) *The March in Campaign;* the work done on the march, the equipment, rests, use of fluids, mental occupation, accidents, strain, and the general health of the troops. (See Marching.) (3) *Water for Drinking,* its purification and protection. (See Encampment.) (4) *The Ration:* its choice, amount, and variety; cooking of meals, disease as related to food, emergency or reserve ration, and travel ration. (See Ration.) (5) *Military Clothing and Equipment* (see Uniform, Military); head-covering, underclothing, disposition of the equipment. (6) *Camp Sites, and Camps,* with attention to soil, vegetation, shelter, and area, and their sanitary administration. (See Encampment.) (7) *Posts, Barracks, and Hospitals.* (See Hospitals, par. *Military.*) (8) *Ventilation, Heating, and Lighting.* (9) *Disposal of Excreta and Waste.* (10) *Personal Cleanliness of the Soldier.* (11) *The Soldier's Diseases and Mortality.* (12) *Disinfection.* (13) *The Habits of the Soldier as Affecting His Efficiency.* (14) *Climate, and Life on a Troop-Ship.* (15) *Disposal of the Dead.*

Bibliography. Willoughby, *Hygiene for Students* (New York, 1901); Harrington, *Practical Hygiene* (New York, 1901); Sedgwick, *Sanitary Science, and the Public Health* (New York, 1902); Hamer, *Manual of Hygiene* (London, 1902); Munson, *The Theory and Practice of Military Hygiene* (New York, 1901). See Sanitary Science; Tuberculosis; Heating and Ventilation.

HYGIENE OF FOOD. See Food.

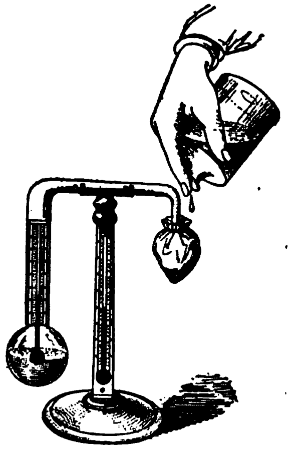
HYGI'NUS, Gaius Julius. A Latin author. He is generally supposed to have been a native of Spain, though some writers claim that he was born in Alexandria, Egypt, and that he came to Rome with Julius Cæsar when a mere child. He is known to have been a favorite with Augustus, who made him chief librarian in the new Palatine Library. He was a voluminous writer on many subjects, including biography, agriculture, bee-keeping, and military arts, as well as comments on the poems of Vergil and Cinna. These have all been lost. There are also two works still in existence that are assigned to him, one, a text-book on mythology, entitled *Fabularum Liber,* consisting of 277 mythological legends, valuable chiefly because of the use made of the Greek tragedies; the other, an astronomical treatise entitled *Poeticon Astronomicon Libri IV.*, of little value now. The *Fabulæ* are edited by Schmidt (Jena, 1872), and the *Astronomica* by Bunte (Leipzig, 1875). Another Hyginus, known as *Gromaticus*, lived probably in the second century, and wrote a work on surveying; edited by Gemoll (Leipzig, 1879).

HYGI'NUS, SAINT. Pope, or Bishop of Rome, about the middle of the second century, possibly 137-141. Very little is known about him.

HYGROM'ETER (from Gk. ὑγρός, *hygros*, moist + μέτρον, *metron*, measure). An instrument for measuring the quantity of moisture in the atmosphere. In addition to the gases of which it is composed, the air contains the vapor of water, which is invisible except when it is condensed in the form of fog or cloud. The amount of this aqueous vapor varies greatly, and depends chiefly on the temperature, being at a minimum on cold days, and on warm days forming as much as one-fiftieth part of the air. This vapor has a certain tension or pressure depending upon the temperature, and when the latter is sufficiently reduced condensation takes place and dew is formed. The temperature at which the air contains a maximum of moisture for a given pressure is called the temperature of saturation for that pressure, and if the temperature is reduced below this point condensation takes place. The temperature at which condensation occurs is known as the dew-point (see DEW) temperature. The less moisture the air contains the lower will be the dew-point, and when this is ascertained experimentally, we can use it to determine the pressure of the vapor at that temperature, as the pressure of water-vapor and its relation to temperature has formed the subject of extensive and elaborate experimental researches that are now embodied in carefully prepared tables. It is known that the quantity of water contained in the air varies directly (or nearly) as the vapor pressure, consequently a ratio between the vapor pressures at an observed temperature, and at the temperature of condensation for the atmospheric condition at the time of observation, would give the relative humidity. It is in terms of relative humidity that the amount of moisture in the atmosphere is expressed in the daily weather reports, and the chief function of the hygrometer is to afford such data as will enable us to determine this quantity.

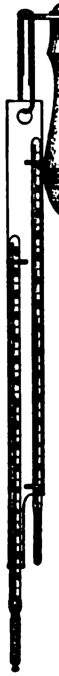
Hygrometers can be divided into several classes. There are those in which use is made of the property of certain substances of altering their dimensions or weight upon absorbing moisture from the air. Of this class the most used are those in which a hair expands and contracts according as the air is more or less moist, and moves a pointer or index over a scale, and indicates relative humidity direct. This form was invented by Saussure, the Swiss physicist, and a somewhat similar instrument was devised by Deluc in which a strip of whalebone was employed. The instruments are known as hygroscopes, and may be used indoors or where only an approximate reading is desired. Another class of hygrometers is based on the principle that certain chemicals will absorb moisture, and the amount thus abstracted from a given volume of air will give the quantity present in the atmosphere. The apparatus consists of a series of drying-tubes containing some hygroscopic material, as substances which readily absorb moisture are termed, through which air is forced by means of an aspirator or other device. The substances which may be used for this purpose are strong sulphuric acid in pumice-stone, calcium chloride, phosphoric acid, and potassium or sodium oxide. The amount of moisture is determined by the increase in weight. The class most generally used, however, includes apparatus where the temperature is reduced until condensation takes place, or this temperature can be determined from the temperature of evaporation. Knowing the dew-point for a given condition of the atmosphere, the other data can be readily ascertained.

The Daniell hygrometer, which figures extensively in the earlier works on physics and meteorology, consists of two bulbs connected by a bent tube, as represented in the figure, and inclosing a thermometer together with some ether, and vapor of ether, the air having been expelled before the tube was sealed. One bulb is either blackened or coated with metal, while the other is covered with muslin. The observer's hand is placed for a short time on the muslin-covered bulb to drive the ether into the opposite bulb, leaving the first bulb and the tube filled with the vapor of ether. A little ether is then dropped from the bottle on the muslin-covered bulb; evaporation instantly takes place, and the temperature is reduced, thus condensing the vapor inside; a fresh evaporation from the other bulb fills the vacuum, and the vapor is again condensed by dropping more ether on the muslin covering, the process being repeated until the temperature of the bulb containing the thermometer is so reduced by successive evaporations (see EVAPORATION) that *dew* begins to be formed on the outside of the bulb. At the instant this occurs, the height of the mercury in the two thermometers is accurately noted, the one giving the dew-point temperature, and the other the temperature of the air. There are other forms of dew-point apparatus, all depending upon this same principle, and the hygrometer of Regnault was devised to remedy some of the defects of the Daniell apparatus. In this instrument a current of air is used to increase the evaporation of the ether, and instead of a glass tube and bulb there is a brightly polished thimble of silver at the base of one of the thermometers, which contains the ether. The air bubbles through the liquid, and the rate of evaporation becomes much more rapid. Knowing the dew-point, a reference to the table will furnish the pressure of aqueous vapor at that temperature, and other tables or the appli-


DANIELL HYGROMETER.

cation of a formula will give the amount of moisture in a given quantity of air.

Instead of the dew-point apparatus, the wet and dry bulb thermometers, or psychrometer, is now generally employed in making ordinary observations, especially by meteorologists. The instrument consists of two ordinary thermometers—one has its bulb bare, and thus shows the temperature of the air, while the other has its bulb covered with muslin which is kept wet with water. The thermometers are often so united that they can be rapidly revolved in order that the wet bulb may be exposed to a constant current of air. In the illustration is shown the sling psychrometer issued by the United States Weather Bureau, where the thermometers are mounted in such a manner that they can be whirled about the hand of the observer. The evaporation from the muslin and the consequent cooling of the bulb being proportional to the dryness of the air, the difference between the readings of the two thermometers is greatest when the air is driest, and zero when it is completely saturated. The readings of the psychrometer and the dew-point apparatus at the same time have been carefully compared, and it has been ascertained that the vapor pressure at the dew-point of air is equal to the vapor pressure corresponding to the temperature of the wet-bulb thermometer minus the number .011, multiplied by the difference in degrees between the dry and wet bulb thermometers. This rule is stated as applying when the psychrometer is whirled, and when the pressure of the barometer is equal to 30 inches. From the difference in readings between the thermometers the vapor pressure can be calculated by formulas which, with certain modifications, are based on those used by Regnault.



U. S. WEATHER BUREAU SLING PSYCHROMETER.

Ferrel's formula, used by the United States Weather Bureau in calculating its tables, is as follows:

Let p = vapor pressure of saturation at dew-point temperature.
p' = vapor pressure of saturation at wet-bulb temperature.
P = barometric pressure, taken as 29.4 in computing the tables.
t = reading of dry thermometer.
t' = reading of wet thermometer.

Then for dew points below 32°

$$p = p' - .000360\ P\ (t - t')\ (1 + .00065\ t')$$

and for dew points above 32°

$$p = p' - .000367\ P\ (t - t')\ \left(1 + \frac{t - t'}{1571}\right)$$

In practice, however, it is usual merely to take the difference between the wet and dry bulb thermometers, and refer at once to the tables, which will give the relative humidity, the amount of moisture in a given quantity of air, and other desired data. These tables and full directions for practical hygrometry are contained in the publications of the United States Weather Bureau, to which the reader is referred for further information, while nearly all the larger treatises on physics contain satisfactory treatment of the subject. Consult also Preston, *Theory of Heat* (New York, 1894). See HUMIDITY.

HY'GROPHYTES (from Gk. ὑγρός, *hygros*, moist + φυτόν, *phyton*, plant). Plants which grow naturally in regions where the atmosphere is moist. Hygrophytes differ from hydrophytes in that they are not necessarily associated with water in the liquid state. Hygrophytic leaves show a number of peculiarities in contrast with xerophytic leaves. For example, hygrophytic leaves do not suffer, but rather thrive, in very moist atmospheric conditions. The leaves themselves are also easily moistened. This type of leaf is very characteristic of the tropical rainy forests. Xerophytic leaves, in contrast with hygrophytic leaves, are not readily moistened, and commonly die if subjected to a moist atmosphere. See HYDROPHYTE.

HY'GROSCOPE. See HYGROMETER.

HYKSOS, hĭk'sōz. The name of a dynasty of Egyptian Kings, who are known also as the Shepherd Kings. Manetho, of whose annals an excerpt is preserved in Josephus, narrates that foreign conquerors from Asia took possession of Egypt who were called Hykussos. This name seems to mean 'foreign kings' (*hyku-khesou*); the explanation, based on the mutilated form Hyksos and interpreting *sos* as Egyptian *shôs*, 'shepherd,' although attributed to Manetho, seems to have originated at a later time. Consequently, we have in this no basis for determining the nationality of those foreigners, 'of unknown race,' as Manetho says. Usually, historians, following this later etymology and the insertion in Manetho ("they are said to have been Phœnicians or Arabs"), consider them as nomadic Semites, either Arabs or Canaanites, recently settled in Palestine. Others have supposed them to be Turanians, thinking that they found Mongolian features on statues which were for a long time attributed to the Hyk(us)sos, but are now generally recognized as belonging to an earlier period. Nothing positive can be said as to the origin of this people; it is only known that the conquerors had first founded an empire in Syria (coming from the north from Asia Minor?) before conquering Egypt. This explains why many Semites came thither along with them and, later, under their rule. The date of their conquest is doubtful. From the confused extracts from Manetho, they would seem to have formed Dynasties Fifteen and Sixteen, lasting 259 and 251 years, respectively, and would thus have begun about 2100 B.C. But Dynasty Sixteen seems to be an erroneous repetition, so that only Dynasty Fifteen with six (?) kings remains, and for these 250 years are certainly too much. Taking into consideration the recently discovered Sothiac date for Dynasty Twelve, not much more than a century would remain for them, and therefore the invasion of the foreigners ought to be placed at about 1700 B.C. The reports of the cruelties and devastations, which, according to Egyptian tradition, accompanied the conquest, are untrustworthy. In one point, however, the traditional account has been confirmed; the invaders built a strong fortress on the northeastern frontier of the delta, in the

Sethroite nome, called Avaris (Egyptian, *Hat-waret*), and placed in it a strong garrison to secure the connection between the Syrian and Egyptian provinces. The conquerors soon adapted themselves to Egyptian manners; leaving probably the old administration untouched, and the Kings assumed Egyptian names. Three or four of these royal names have been found on the monuments. The six Kings of this dynasty were: Salatis or Saites; Beon (possibly Kheyân of the monuments); Apophis I. or Apachnan (hieroglyphic *Apopi a-qnan*); Apophis (*Apopi a-user-rê*), who seems to have been misplaced by Manetho and to belong to the end of the series, after Iannas and Archles (or Asses?). Perhaps these last two names are merely corrupt repetitions of the preceding. The second Apophis reigned for at least thirty-three years, as the mathematical papyrus of London written in his reign attests; for the other Kings we have only the corrupt Manethonian dates (nineteen, fourteen, thirty-nine years, etc.). These Kings resided in Memphis, Avaris, and Heliopolis (?), having the Delta under their direct administration, and leaving the country above Memphis to tributary princes of the old nobility. This proved fatal to their dominion, for the vassal Prince of Thebes soon felt strong enough to rebel against his sovereign. A popular tale (Papyrus Sallier I.) gives a fanciful narrative of the beginning of this war, but the mutilated condition of the manuscript renders it difficult to decide whether the foolish arrogance of Apopi or his exaggerated zeal for his god Set is represented as the cause of the struggle. The popular idea that the Hyk(us)sos brought along their own native god of war, Sutekh, and tried to force his exclusive worship upon the Egyptians, is incorrect; this god was merely the Egyptian divinity Set (playfully written Sutekh), the local god of the capital, Avaris, who became, of course, the official patron of the Kings, but did not dispossess any other cults. The revolt against Apopi (II.?) was started by Sqenen-rê, the Prince of Thebes (which of the three princes of that name is doubtful), and lasted for long years, extending through the reigns of two short-lived Theban princes (Kames and Snekhten-rê).

The princes of the nomes north of Thebes were annihilated in the war of independence, as they do not seem to have joined the national cause. When Amasis I. (Ahmose, c.1600 B.C.) ascended the throne, the Pharaohs of the foreign dynasty seem to have been almost completely expelled, but they sustained a long siege in their last stronghold, Avaris. This city fell in the third or fourth year of Amasis Ahmose and the surviving inhabitants were distributed as slaves. The strange statement in Manetho that Misphragmuthosis (i.e. Thothmes III., c.1500 B.C.) took Avaris and allowed the remainder of the Hyk(us)sos to retire to Syria, is, of course, erroneous. No remarkable buildings of the Hyk(us)sos Kings have survived; only traces of temple restorations in Bubastis and the modern Gebelên. Possibly their constructions were destroyed after the expulsion. A considerable part of Syria seems to have been tributary to them, but the small stone lion bearing the name of Apopi (I.?), found at Bagdad on the Tigris, cannot be considered to prove that these monarchs ruled as far as Babylonia. The whole of this interesting portion of Egyptian history is very obscure. Consult: Koch, *De Regibus Pastoribus* (Marburg, 1844); Chabas, *Les pasteurs en Egypte* (Amsterdam, 1868); W. M. Müller, in *Mitteilungen der vorderasiatischen Gesellschaft* (Berlin, 1898).

HY'LA (Neo-Lat., from Gk. ὕλη, *hylē*, wood). The typical genus of the tree-frog family, Hylidæ; hence the word is often used as a name for tree-frogs in general, especially the common variable one (*Hyla versicolor*) of North America. See TREE-FROG.

HYLÆ'US (Lat., from Gk. Ὑλαῖος, *Hylaios*, woodman). In Greek mythology, an Arcadian centaur who pursued Atalanta and was slain by her. In other legends he falls in the fight against the Lapithæ, or is slain by Hercules.

HYLAS, hī'las (Lat., from Gk. Ὕλας). In Greek legend, son of Theodamas or Theiomenes, favorite of Hercules, who took him on the Argonautic expedition. In Mysia, near the mouth of the Cios, while drawing water from a spring he was made captive by the nymph of the place. Hercules returned in sorrow to Greece, taking with him hostages of the Mysians, and requiring that they should continue the search for his beloved. The story was developed by the later Greek writers, and seems to have arisen from a Mysian religious festival, where a priest thrice called the name of Hylas. Consult Mannhardt, *Mythologische Forschungen* (Strassburg, 1884).

HYLLESTED, hụl'le-stĕd, AUGUST (1858—). A Swedish pianist and composer, born of Danish parents, at Stockholm, Sweden. He showed great musical precocity, playing in public when only five years old. He studied under Holger Dahl in Copenhagen, until 1869, and then, after making a concert tour in Scandinavia, entered the Royal Conservatory of Copenhagen. In 1876 he was appointed organist of the cathedral there, and director of the Nykjøbing Falster, a musical society. Three years later he studied with Kullak and Kiel in Berlin, leaving there to become a pupil of Liszt. He made many notable concert tours in Europe and America, and was the recipient of numerous honors. He was assistant director of the Chicago Music College (1886-91), and director of the piano department in the Gottschalk Lyric School (1891-94). In the latter year he went to Europe for an extended concert tour, and upon his return, in 1897, settled in Chicago. His compositions, the most popular of which are his songs and piano pieces, include: the symphonic poem, *Elizabeth*, for full orchestra and double chorus; *Suite romantique*; *Marche triomphale*, etc.

HYL'LUS (Lat., from Gk. Ὕλλος). The son of Hercules and Deianira, married at his father's command to Iole. When Eurystheus was repulsed by the Heraclidæ with the aid of the Athenians, Hyllus slew him as he fled. Adopted by the Dorian Ægimius in Thessaly, he gained the leadership of the Dorians for himself and his descendants. Having invaded the Peloponnesus in obedience to a command of the Delphic oracle to seize the Kingdom of Eurystheus 'after the third fruit,' he was unsuccessful and was killed in combat by King Echemus of Tegea. The oracle was fulfilled in the persons of his great-grandsons Temenus, Cresphontes, and Aristodemus, who after the third generation conquered the Peloponnesus.

HYLO'DES. A genus of cystignathine frogs, about 50 species of which are known in tropical America, all small and like tree-frogs, with the fingers free and provided with undivided disks. A typical and familiar species of the West Indies (*Hylodes Martinicensis*) has some remarkable traits, described under COQUI.

HY'LOPHYTES (from Gk. ὕλη, *hylē*, forest, matter + φυτόν, *phyton*, plant). Plants which grow in the woods; forest plants. The hylophytes are contrasted with the poöphytes, i.e. the plants of grasslands.

HY'LOZO'ISM (from Gk. ὕλη, *hylē*, matter, wood + ζῳον, *zōon*, animal). The assumption that the principle of all change is to be found in material substance, and that all matter is instinct with life. The term is applied to the Ionic School (see GREEK PHILOSOPHY), which sought the explanation of the universe in terms of water, air, fire, ètc., and thus assumed, without further investigation, that matter in one form or another had in it 'the promise and potency' of all change, including vital processes.

HYMANS, ē'mäN', LOUIS (1829-84). A Belgian historian, poet, and publicist, born at Rotterdam. He was editor of various papers, and director of the *Echo du Parlement*, a liberal journal. He was elected a member of the Belgian Chamber of Representatives for the city of Brussels (1859), held that post for eleven years, and showed himself an upright and conscientious politician. He was the author of several novels, of *Lettres moscovites* (1857); *Histoire populaire de la Belgique* (18th ed. 1880); *Histoire populaire du règne de Léopold I.* (1864); *Histoire politique et parlementaire de la Belgique* (1869-70); *Notes et souvenirs* (1876); *Types et silhouettes* (1877), reminiscences; and *Bruxelles à travers les âges* (1883-89).—His brother, HENRI SIMON (1836—), an author and critic, was born at Antwerp. He was appointed conservator of the Royal Library of Brussels, and became a constant contributor to art journals. His best-known work is *Histoire de la gravure dans l'école de Rubens* (1879).

HY'MEN, or **HY'MENÆ'US** (Lat., from Gk. Ὑμήν). The Greek god of marriage, whose name survived in the refrain of the marriage song, though the original meaning ('begetter') was forgotten, and many legends devised to explain the occurrence in the hymn. The myths usually represent him as son of Apollo and a Muse, more rarely of Dionysus and Aphrodite. In art he is usually represented as a youth of delicate, almost feminine beauty, with a crown of flowers and a torch; more rarely with wings. Consult: Schmidt, *De Hymenæo et Talasio* (Kiel, 1886); Usener, *Götternamen* (Bonn, 1896).

HY'MENOCEPH'ALUS (Neo-Lat., from Gk. ὑμήν, *hymēn*, membrane + κεφαλή, *kephalē*, head). A genus of small pelagic fishes of the tropics, of the family Macruridæ (see GRENADIER), noted for the papery nature of the bones of the cranium. The only known species (*Hymenocephalus cavernæus*) is gray, with silvery tints on the sides, and was taken from deep water in the Gulf of Mexico. See Plate of CODFISH AND ALLIES.

HYMENOPHYLLITES, hī-mĕn'ō-fĭl-lī'tēz, AND **HY'MENOPHYL'LUM** (Neo-Lat. nom. pl., from Gk. ὑμήν, *hymēn*, membrane + φύλλον, *phyllon*, leaf). A genus of ferns, comprising the film ferns and lace ferns, found growing parasitically on roots of trees and in other like situations, and characterized by their delicate membranaceous leaves with cup-shaped spore-cases situated at the ends of the veins, and their creeping rootstocks. The family containing them is one of the most primitive of the modern ferns, and also one of the earliest to appear in the geological records; for fossil leaves, called Hymenophyllites, very similar to those of the modern living genus Hymenophyllum, are found in the Devonian rocks of Europe. It is also known in the coal-measure flora of Carboniferous time, and in the Eocene flora. The fossil fern genus Sphenopteris is very similar in form to Hymenophyllites, and can with difficulty be distinguished from the latter. See FERN.

HY'MENOP'TERA (Lat. nom. pl., from Gk. ὑμενόπτερος, *hymenopteros*, membrane-winged, from ὑμήν, *hymēn*, membrane + πτερόν, *pteron*, wing). An order of insects, containing the ants, bees, wasps, ichneumon-flies, saw-flies, gall-flies, and related insects, elsewhere described under their names. The order includes a very great number of species, estimated at about one-fourth of the whole class, of which some, as ants and bees, are singularly interesting and important. They have the mouth furnished with mandibles for cutting and tearing, but the other parts of the mouth are adapted for suction, and are generally narrow and elongated, often united into a kind of proboscis, as in bees. (See BEE.) The antennæ are generally slender, but often exhibit differences in the sexes of the same species. The wings are four in number, the first pair larger than the second, the wings of the same side united in flight by little hooks. The wings, when at rest, are laid over one another horizontally over the body. The wings are entirely membranous, not reticulated as in the Neuroptera, but with comparatively few nervures, the arrangement of which is so constant in the whole order that particular names have been given to them and to the space between them, and their diversities have been made use of in classification. The wings are wanting in the imperfectly developed females ('neuters') of some. Besides the ordinary eyes, all the Hymenoptera have three small, simple eyes (ocelli), on the top of the head. The abdomen is generally united to the thorax by a slender pedicel. The abdomen of the females is generally furnished with an organ capable of being protruded, but for different purposes in different sections of the order, it being in some of the groups an ovipositor or borer, and in others a sting.

The Hymenoptera in their perfect state generally feed on honey, but some of them prey on other insects, which are the food of the larvæ of a greater number; while the larvæ of some feed on various vegetable substances. The metamorphoses of the insects of this order are perfect; the larvæ are generally—although not in all the families—destitute of feet; the pupæ take no food. The Hymenoptera are remarkable for the dilatation of the tracheæ or air-tubes into vesicles, and the general perfection of the respiratory system. The instincts and even apparent intelligence displayed by some of them—particularly the social kinds, which live in communities—have excited admiration from the earliest times. See INSECT, paragraph *Social Insects.*

Fossil Hymenoptera. These appear in the Mesozoic formations in small numbers. Only about a dozen species are known, mainly from the Jurassic limestones of Solenhofen, Bavaria. The oldest hymenopterans are ancestral to the modern ants. In the Tertiary deposits are found representatives of all the important families in fossil forms very close to the modern species. In America the best examples are found at Florissant in Colorado, and in Europe the fresh-water shales of Aix, Œningen, and Radoboj, and best of all, the amber of the Baltic Provinces, are noted localities. Consult Scudder, "Systematic Review of Our Present Knowledge of Insects," in *United States Geological Survey Bulletin*, No. 31 (Washington, 1886).

Classification. The order Hymenoptera is divided into two suborders, each containing several superfamilies, as follows:

Suborder *Heterophaga*.—Superfamilies: Apoidea, true bees; Iphecoidea, solitary wasps; Proctotrypoidea, proctotrypoid parasites; Vespoidea, social wasps; Formicoidea, ants; Ichneumonoidea, ichneumon-flies; Cynipoidea, gall-flies; Chalcidoidea, chalcis-flies.

Suborder *Phytophaga*.—Superfamilies: Siricoidea, horntails; Tenthredinoidea, saw-flies.

Bibliography. Cresson, *Catalogue and Synopsis of the North American Hymenoptera* (Philadelphia, 1887); Ashmead, *Superfamilies in the Hymenoptera* (New York, 1899); Ashmead, *The Habits of the Hymenoptera* (Cambridge, 1893); Howard, *The Insect Book* (New York, 1901); Sharp, *Cambridge Natural History*, vol. v. (London, 1895).

HYMET'TUS (Lat., from Gk. Ὑμηττός). A mountain range in Attica, about 3000 feet high, now called Trelo-Vuni, between four and five miles east of Athens, famous to-day, as well as anciently, for its honey of excellent flavor. There was also quarried at Hymettus a bluish-gray marble, much prized in antiquity.

HYMNOL'OGY (Gk. *ὑμνολογία*, *hymnologia*, from *ὑμνολόγος*, *hymnologos*, singing hymns, from *ὕμνος*, *hymnos*, hymn; connected with Skt. *syûman*, bond, Lat. *suere*, to sew, Gk. *κασ-σύειν*, *kas-syein*, to make shoes, OChurch Slav. *šiti*, to sew, Goth. *siujan*, OHG. *siuwan*, AS. *seowian*, Eng. *sew* + Gk. *-λογία*, *-logia*, account, from *λέγειν*, *legein*, to say). The science of hymns, or the collective body of hymns used at a particular time or place. In the most general sense a hymn is a religious ode or poem; more specifically it is a metrical composition divided into stanzas or verses, intended to be used in worship. In some variety or form the hymn has been thus employed throughout the ages. Lenormant publishes an old Accadian hymn, sung to the moon-god Hurkis, that may have been used at Ur five thousand years ago. The Assyrian tablets furnish many specimens of the so-called penitential hymns. (Consult *Records of the Past.*) The religion of ancient Egypt produced hymns of beauty and power. (Consult Renouf, *Religion of Ancient Egypt.*) In India on anniversary days and in processions there are songs sung to the gods, but these are not of a high character. The Vedic hymns are many of them productions of worth. Buddhist hymns seem to be chiefly for recital or meditation, not for worship. Confucius made a collection of poetry, forty pieces of which are called 'praise songs' or 'songs of the temple and altar.' The Mohammedans have no hymns; they have invocations and addresses. Greece was the land of song, and there was heard a song on every occasion by every class to celebrate every event. The so-called Homeric hymns consist of brief addresses to the gods. Callinus, the father of elegy (c. 700 B.C.), and Archilochus, a contemporary, wrote hymns, but none of them have reached us. Simonides, Tyrtæus, Solon of Athens, Alcæus, and Sappho wrote lyric poetry. Roman worship was silent and reverential, but the priests used songs, and the poets wrote odes and lyrics. Of the hymns of the New World we know but little. Reville gives a sample of the hymns used in the time of the Incas in South America. The hymns, or rather incantations, of the North American Indians are inferior in quality, though not lacking in weirdness.

It is the Hebrew race which produced the highest development of worship poetry before the Christian Era, and it is a generally conceded fact that the Hebrew Psalter has never been equaled as a whole. We get glimpses of the kindred arts, music and poetry, very early in the Hebrew Scriptures. Jubal was "the father of all such as handle the harp and organ" (Gen. iv. 21). And in the same connection we hear of the song of Lamech (Gen. iv. 23-24), perhaps the earliest song of Scripture. The song of Miriam (Ex. xv. 21) is the only one preserved of many possible improvisations that she may have produced. The Ninetieth Psalm has been attributed to Moses, and has been aptly described as the 'swan song of Moses.' In the Book of Numbers (xxi. 14) we find the mention of the "Book of the Wars of the Lord," which some suppose to be a collection of songs and ballads composed by the campfire. In the same chapter (xxi. 17-18) is given the song "Spring Up, O Well." One of the great songs of the Old Testament is that of Deborah and Barak (Judges v.). It is cast in a distinctly metrical form. The song of Hannah (I. Sam. ii.) reminds of the song of Mary (Luke i. 46-55) and it might be called the Magnificat of the Old Testament. The schools of the prophets knew of the soothing influence of music and used it in prophecy, and with it they may have used song also. With the founding of the Temple was founded the temple of Hebrew song. Scholars are not agreed as to the number of psalms composed by David. The estimate runs from ninety-five down to none. Solomon is said to have written 1005 songs, but only two Psalms (lxxii. and cxiii.) have his name prefixed to them. His other poetical productions are rather didactic than lyrical. The Psalms contain many of the poetical productions of exilic and post-exilic times. Jonah ii., Isaiah xii., and Habakkuk iii. are also poetical productions. Robert Lowth was the discoverer of the metrical arrangement of Hebrew poetry, first publishing his discovery in 1753. Michaelis, Herder, Rosenmüller, De Wette, Gesenius, Rau, Hollmann, Gustav Bickel, and others have contributed something to the understanding of the subject.

In the New Testament the hymn note is changed. The centre is a person, not a race. The *Magnificat* of Mary (Luke i. 46-55) is a witness to her talent as a daughter of David, and her piety as a true Israelite. Her song has been much used by the Church, rarely, however, in metrical form. The best metrical version is that of W. J. Irons. The song of Elizabeth

(Luke i. 42-45), sometimes called the *lesser Benedictus*, and the song of Zacharias (Luke i. 68-79), the *Benedictus*, were in use in the Church as early as the time of Saint Augustine. The *Nunc Dimittis* of Simeon (Luke ii. 29-32) was used in Christian worship as early as the sixth century. The *Gloria in Excelsis* of the angels (Luke ii. 14) in its present form appears in the *Codex Alexandrinus* of the fourth century, thus proving its early use. The Epistles of Paul contain hymns. In Colossians iii. 16 we have a reference to the use of Psalms in public worship. Other hymns are found in Ephesians v. 14; I. Timothy iii. 16; vi. 15-16; II. Timothy ii. 11-13; the parallelism of this last passage is very marked. In the Apocalypse the language is naturally poetic, and there are several passages which might have been hymns; i. 4-8; v. 9-10, 12-14; xi. 15, 17, 18; xv. 3, 4; xxi. 10-14; xxii. 17.

One of the earliest references to be found in regard to the worship of the early Church is in the famous letter of Pliny to Trajan (A.D. 103) in these words: "They [the Christians] had been accustomed to come together on a fixed day before daylight, and to sing responsively a song to Christ as God." What this song was we do not know. Unfortunately, the first hymn-book of the Church is lost. This book was compiled and largely written by Justin Martyr. It was entitled *Psaltes*, and is mentioned by Eusebius, Jerome, and Gennadius. The Ante-Nicene Fathers bear testimony that hymns were used by the Church. We have one hymn entire appended to *The Instructor* of Clement of Alexandria (c.200 A.D.). It is the earliest Christian hymn extant, and may be Clement's, though by some supposed to be earlier than his time. It is entitled *A Hymn to Christ the Saviour*. The best translation is by Dean Plumptre, but the most common one is by Henry M. Dexter, beginning "Shepherd of tender youth." The next hymn is that mentioned by Saint Basil (c.330-379) in his treatise *On the Spirit*, and sometimes called the *Candlelight Hymn*, because sung in church at the lighting of the lamps. It begins "Joyful light of the holy glory." It has been translated many times. The best known translations are those of John Keble and Henry W. Longfellow. The chief Eastern liturgies contain the well-known *Cherubic Hymn*, beginning "Let us who mystically represent the Cherubim," dating from the time of Justinian (527-565). Methodius, who suffered martyrdom in the year 312, composed a hymn which is found in the *Banquet of the Ten Virgins* (*Discourse* xi. ch. 2), beginning "Up, maidens, the sound of the cry that raiseth the dead." The Gnostics composed many hymns to further the spread of their doctrines. Valentinus (d. 160) wrote many of the most profound. Bardesanes (d. 223) is said to have composed one hundred and fifty hymns. His son, Harmonius, was also a writer of hymns. They are sometimes called the fathers of Syrian hymnology. But that honor really belongs to Ephraem Syrus (d. 378), a poet of no mean order, who wrote to counteract the work of the Gnostics, as a little later Chrysostom (d. 407) did to counteract the work of Arius. With Ambrose (d. 397) begins a great uplift of the art of hymn-writing. To him is attributed the hymn *Te Deum laudamus*, though probably written in part at least at a much later date. There are ninety-two of the hymns of the Ambrosian school yet in existence. Ambrose also reformed the music of the Church, and his form of chant was used until the introduction by Gregory the Great (d. 604) of the Gregorian chant.

Both Greek and Latin hymnologists were active during the Middle Ages. In the Greek Church Saint Andrew of Crete (660-732), Saint John of Damascus (d. 787), and his foster-brother Cosmas (d. 760), were followed by the poets of the Studium, Saint Theodore (d. 826), Saint Theophanes (c.800-850), and Saint Joseph (c. 840), the most prolific of them all. The Church is greatly indebted to John Mason Neale (1818-66) for his translations from Greek sources, which however, were by no means close; indeed, he greatly improved upon his originals. In the Latin Church Aurelius Clemens Prudentius (d. c.413) was a prolific writer of hymns. Cœlius Sedulius (fl. 450) was the next writer of note. Ennodius (c.473-521) composed a few hymns. Venantius Fortunatus (d. 600) was a writer of much power. He is best known to us by his passiontide hymn *Vexilla regis prodeunt*, which in the translation of John Chandler begins, "The royal banner is unfurled." We are under obligation to Robert II., King of France (d.1031), for *Veni, Sancte Spiritus* ("Come, Holy Spirit"), and three other hymns. The great hymn *Veni, Creator Spiritus* ("Come, Creator Spirit") is sometimes attributed to Charlemagne, to Ambrose, Gregory the Great, or Rabanus Maurus. The last-named writer did compose hymns of merit, but this is not to be included. Saint Bernard of Clairvaux (d. 1153) is a name that belongs to the whole Church. He contributed a long poem on the "Name of Jesus." This contains several passages that have been used for hymns. Saint Bernard of Cluny (d. 1156) is not so well known personally, yet we can never sing of heaven in the highest strain without using John Mason Neale's translation of a part of his *De contemptu mundi*, which he called *Bernard's Rhythm on the Celestial Country*, especially the verses beginning "Jerusalem the golden." Thomas of Celano (fl. 1220), the friend of Saint Francis of Assisi, has given us the marvelous judgment hymn *Dies Iræ* ("Day of Wrath"). Saint Thomas Aquinas the Schoolman (d. 1274) wrote *Pange, lingua, gloriosi corporis mysterium* ("Sing, tongue, the mystery of the glorious body"). To Jacopone, the Italian Franciscan monk, we owe the *Stabat Mater* ("The Mother [i.e. the Virgin Mary] stood"). These hymns were the principal great hymns before the time of the Reformation.

One of the great results of the Reformation was the use of the vernacular in Church worship. Luther was the first hymn-writer of the German Church, enriching its worship with no less than thirty-seven hymns. The best-known is *Ein' feste Burg ist unser Gott* ("A Mighty Fortress is our God"). The first evangelical hymn-book of 1524 contained eight hymns. Subsequent editions contained more and more until that of 1553 contains one hundred and thirty-one. Co-workers with Luther added much to the hymnology of the Church. Justus Jonas (1493-1555); Paul Eber (1511-1569); Erasmus Alber (d. 1553); Lazarus Spengler (1479-1534); Hans Sachs, the shoemaker poet of Nuremberg (1494-1576); Paul Speratus (1484-1551); and others among the early Reformers published hymns of value. The Bohemian Brethren, notably Michael Weisse (d. 1534), furnished a number of hymns in this period. Their hymns breathed a deep spiritual atmosphere. The French Reformation produced the poetical translation of the Psalms by Clément Marot (d. 1544) and Theodore Beza (d. 1605); the German Reformed hymn-book of 1540 published at Zurich; and the Genevan Psalter of Calvin of 1562. In England the Reformers issued Miles Coverdale's *Goostly Psalmes and Spiritualle Songes* (London, 1539); Robert Crowley's versification of the Psalter and Litany (1549); and, last and most famous of all, the rendering of the Psalms by Thomas Sternhold and John Hopkins (1560).

The time of the Thirty Years' War was marked by the production of many fine German hymns of a more or less martial character. The principal composers were Martin Opitz (1597-1639); Johann Heermann (1585-1647); Johann Michael Altenburg (1584-1640), who composed part of the battle hymn of Gustavus Adolphus, "Fear not, O little flock, the foe;" Paul Fleming (1609-40), author of the *Pilgrim Hymn*, beginning "In all my deeds;" and Martin Rinkart (1586-1649), who composed the German Te Deum *Nun danket alle Gott* ("Now thank we all our God").

Germany continued to produce great hymns and hymn-writers after this period. Paul Gerhardt (1607-76) wrote one hundred and twenty-three hymns. Many have been translated into English, and some are in common use. Probably the most familiar is "O sacred head once wounded," translated by John Wesley. Johann Franck (1618-77), burgomaster of Guben, anticipated the Pietists in his mysticism as shown in his hymns. Johann Rist (1607-77) produced 610 hymns, a few having merit. Johann Scheffler, known as 'Angelus Silesius' (1624-77), was a writer of force, and some of his hymns are yet used. All the hymns of the period are somewhat mystical in their teachings.

Pietism was a reaction against Protestant Scholasticism, and swung to the other extreme of Mysticism. The leaders of the movement, Philipp Jacob Spener (1635-1705), and August Hermann Francke (1663-1727), wrote a few hymns. Christian Friedrich Richter (1676-1711) wrote thirty-three hymns. Johann Anastasius Freylinghausen (1670-1739) wrote a few hymns, and published the first hymn-book of the movement at Halle in 1704. Gottfried Arnold (1666-1714), the Church historian, wrote several hymns of value. Joachim Lange (1670-1744), a friend of Francke, wrote the morning hymn, *O Jesu, süsses Licht.* ("O Jesus, sweet light"). Johann Friedrich Starck (1680-1756) of Frankfort wrote 939 hymns. Karl Heinrich Bogatzsky (1690-1774) wrote hymns, as well as devotional works. Philipp Friedrich Hiller (1699-1769) of Württemberg wrote many hymns. The Moravian Church has produced many fine hymns, some of which have been translated by John Wesley, Miss Catherine Winkworth, and others. Count Nicolaus Ludwig Zinzendorf (1700-60) produced 2000 hymns. "Jesus, Thy blood and righteousness," and "I thirst, thou wounded lamb of God," have been favorite translations from his hymns. Bishop August Gottlieb Spangenberg (1704-92) wrote ten hymns. That on Christian simplicity, beginning "Holy simplicity, miracle of grace," written as a birthday hymn for his sister, is considered his best. Christian Gregor (1723-1801) compiled the Moravian hymn-book of 1778, published at Barby, still in use. To this he contributed several hymns. The inspiration of the hymnology of the Evangelical Revival in England can be traced directly to the Moravian Brethren. To this period belong a few other hymn-writers of note, such as Joachim Neander (1650-80), sometimes called the 'Psalmist of the New Covenant,' and Friedrich Adolph Lampe (1683-1729), the author of thirty hymns. Gerhard Tersteegen (1697-1769), a ribbon-weaver, produced one hundred and eleven hymns, some of which are worthy to be placed in the first rank. From the writers of this school we have the first introspective hymns of value.

The hymns of the Evangelical Revival are not by any means the first great hymns produced in England. The Elizabethan period produced the hymn by F. B. P. (the initials may stand for Francis Baker, pater, i.e. priest), "Jerusalem, my happy home," translated from the Latin; also the first English hymn-book. This was by George Wither, and was published in London in 1623. The Puritans produced as hymn-writers, Robert Herrick (1591-1674); John Milton (1608-74); Henry Vaughan (1622-95); and Jeremy Taylor (1613-67). In the Restoration period Samuel Crossman published *The Young Man's Meditation* (1664), which contains several hymns, a good specimen of which can be seen in Lord Selborne's (Sir Roundell Palmer) *Book of Praise* (1863). Henry More in his *Divine Dialogues* (1668) published seven long hymns on the festivals of the Church. But the greatest lyric poet of the period was Thomas Ken (1637-1711), the good Bishop of Bath and Wells. His evening, morning, and midnight hymns stand at the head of all worship poetry of the English language. The first two have never been surpassed, and hardly approached. Joseph Addison, his contemporary, furnished a few hymns of an exalted character. In 1683 John Mason published *Songs of Praise*, a hymn-book which went through many editions. Benjamin Keach published *Spiritual Melody* (1691), the first Baptist hymn-book. Among Independents the first hymn-book used was *A Collection of Divine Hymns* (1690). The metrical version of the Psalms by Sternhold and Hopkins was followed by that of Francis Rouse (1646), and that in turn by Nahum Tate and Nicholas Brady (1696), which exerted a great influence. The tendency, however, came to be less and less to base hymns on the Hebrew Psalter for a whole hymn-book. A preparation for the work of Isaac Watts (1674-1748), sometimes called the 'father of English hymnody,' was thus made. His hymns have been more widely sung than those of any other English writer, with the possible exception of Charles Wesley. His first work, *Horæ Lyricæ*, appeared in 1706; *Hymns and Spiritual Songs* in 1707. Besides these he published *Divine and Moral Songs for Children* (1720), long extremely popular. To the school of Watts belongs Philip Doddridge (1702-51). His hymns were almost all written to follow sermons, reënforcing the truth which had been preached. The Wesley family, and the men who gathered about them, both in and out of the Church of England, were prolific writers, and produced some of the best hymns in the history of the Church. Samuel Wesley (1662-1735) was no mean poet. His son, John (1703-91), translated several hymns, and mended many more. Samuel, Jr. (1691-1739), wrote some hymns. To Charles (1707-88), however, we must turn as the leader of the lyrical forces of the Evangelical Revival. He wrote over 6000 hymns. Out of three hundred and twenty-five standard hymns James King assigns twenty-two to Charles Wesley, a larger number than ascribed to any other writer. At the present time not far from four hundred of his hymns are in common use. They include a wider range of subjects than those of any other writer of hymns. They chronicle the events of the time as well as the devotional experiences of the writer. Some were impromptu. Many have bits of personal history as a background. Around some hymns have grown beautiful stories, the historical data for which is exceedingly slight. The original hymn-books of the Wesleys were issued in thirteen volumes under the direction of George Osborn (London, 1868-72). Thomas Olivers (1725-99), John Cennick (1718-55), Edward Perronet (1721-92), and John Bakewell (born 1721), were of the Wesleyan party; while John Gambold, the Moravian (1711-71), Joseph Hart (c.1712-68), Miss Anne Steele (1717-78), John Newton (1725-1807), William Cowper (1731-1800), Robert Robinson (1735-90), John Fawcett (1740-1817), Augustus Montagu Toplady (1740-78), Joseph Swain (1761-96), William Williams (1717-91), and still others were more or less affected by the movement. The hymns of the movement are characterized by greater breadth of view than any previously issued. They include hymns of all kinds, but very few didactic hymns.

Hymns of modern days seem to have been produced by small groups of men representing some movement or belief. (a) The missionary movement produced James Montgomery (1771-1854) as its first hymn-writer and Reginald Heber (1783-1826) as its ablest. Both produced many hymns other than missionary. (b) The Oxford movement was characterized by its hymnological productions, as well as its works of devotion and argument. John Keble (1792-1866), with his *Christian Year*, Frederick William Faber (1814-1863), Edward Caswall (1814-78), John Henry Newman (1801-90), author of "Lead, kindly light," and Isaac Williams (1802-65) were the singers of this group. Their work evinced not only a deep piety, but an unsurpassed scholarly finish. (c) The Sunday-school movement has produced a great many hymns. Among the first publications was William Batchelder Bradbury's *Golden Chain* (New York, 1861). (d) The evangelistic movement of Messrs. Moody and Sankey brought into the Church a class of hymns entirely different from those produced by any other movement. Many were not of high order, in fact were a disgrace to the Church, but they were so widely used that this article would be incomplete without a notice of them. Beginning with *Select Hymns*, *The Gospel Hymns* in six numbers (1875-95) were followed by hymn-books whose name is legion and whose copies are millions. The most voluminous writer of this movement has been 'Fanny Crosby' (Mrs. Frances Jane [Crosby] Van Alstine). (e) The Salvation Army has not added much to the hymnology of the Church; it has, however, changed the class of music used, and not for the better.

In an article of this kind there must of necessity be many omissions. Only a few of the greatest hymn-writers can be mentioned. Four women have written hymns any one of which is worth a lifetime to produce. Mrs. Sarah Flower Adams (1805-48), "Nearer, My God, to Thee;" Miss Charlotte Elliot (1789-1871), "Just as I am without one plea;" Miss Phœbe Cary (1824-71), "One sweetly solemn thought;" and Mrs. Phœbe H. Brown (1783-1861), "I Love to Steal Awhile Away." The Unitarians have produced some remarkable hymn-writers, such as John Pierpont (1785-1866), Henry Ware, Jr. (1794-1843), William Bourne Oliver Peabody (1744-1847), William Cullen Bryant (1794-1874), the Longfellows (Henry Wadsworth, 1807-82, and Samuel, 1819-92), Edmund Hamilton Sears (1810-76), Theodore Parker (1810-60), Stephen Greenleaf Bulfinch (1809-70), James Thomas Fields (1817-81), and Thomas Wentworth Higginson (1823—). The Protestant Episcopal Church has to offer the names of Bishop George Washington Doane (1799-1859), Bishop Phillips Brooks (1835-93), Bishop George Burgess (1819-66), and the Rev. Dr. William Augustus Muhlenberg (1796-1879). The Presbyterian Church has the names of Samuel Occam (1723-92), Samuel Davies (1723-61), Thomas Hastirgs (1784-1872), the Alexanders (James Waddell, 1804-59, Joseph Addison, 1809-60), Thomas Mackellar (1812—), Mrs. Elizabeth Prentiss (1818-78), and Charles Seymour Robinson (1829-99), the compiler of *Songs for the Sanctuary* and *Laudes Domini*. The Congregationalists have enrolled the names of Timothy Dwight (1752-1817), Joel Barlow (1755-1812), Nehemiah Adams (1806-78), Ray Palmer (1808-87), author of the immortal "My faith looks up to Thee," Henry Martin Dexter (1821-90), Jeremiah Eames Rankin (1828—), and Horatio Richmond Palmer (1834—). The Baptists furnish a long list with the names of Oliver Holden (1765-1844), Adoniram Judson (1788-1850), Mrs. Lydia Sigourney (1791-1865), Robert Lowrie (1826—), William Howard Doane (1831—), and Samuel Francis Smith (1808-95), author of "My country, 'tis of thee." The Methodists produced the first hymnologist of the American Church, David Creamer (born 1812). His *Methodist Hymnology* appeared in New York in 1848. Other Methodist hymn-writers are Miss Hannah Flagg Gould (1789-1865), Thomas Hewlings Stockton (1808-68), William Hunter (1811-1877), Thomas Osmund Summers (1812-82), Robert Arthur West (1809-66), President William Fairfield Warren (1833—), and Professor Caleb Thomas Winchester (1847—). Other American hymn-writers are John Greenleaf Whittier (1807-92), Hosea Ballou (1771-1852), Edwin Hubbell Chapin (1814-80), Charles Dexter Cleveland (1802-69), Miss Lucy Larcom (1826-93), Mrs. Emily Miller (1833—). The later writers of the Church of England include the names of Christopher Wordsworth (1807-85), Henry Alford (1810-71), John Samuel Bewley Monsell (1811-75), William Josiah Irons (1812-83), Arthur Penrhyn Stanley (1815-81), John Mason Neale (1818-66), Sir Henry Williams Baker (1821-77), Edward Hayes Plumptre (1821-91), John Ellerton (1826-93), William Walsham How (1823-97), and Samuel John Stone (1839—), and these are only a few of many. Other English writers of note are Horatius Bonar (1808-90), Frances Ridley Havergal (1836-79), James Drummond Burns (1823-64), Thomas Toke Lynch (1818-71), Norman Macleod (1812-72), Andrew Young (1807-89), John Burton (1803-77), Henry Francis Lyte (1793-1847), Sir Edward Denny (1796-1889), Josiah Conder (1789-1855), Henry Kirke White (1785-1806), Sir Robert Grant (1785-1838), Bernard Barton

(1784-1849), and Mrs. Felicia Dorothea Hemans (1793-1835).

Hymns, Ancient and Modern, originally compiled by a committee of which Sir H. W. Baker was secretary, and published in London in 1861, with supplemental hymns published in 1889; and *The Congregational Psalmist* (1858), edited by Henry Allon, and *Church Hymns* (1871), edited by Canon John Ellerton, are the greatest hymn-books of England. *Laudes Domini* (New York, 1884), edited by Charles Seymour Robinson; *The Plymouth Collection* (1855), by Henry Ward Beecher; *The Evangelical Hymnal* (1880), of Charles Cuthbert Hall and Sigismund Lasar; the Protestant Episcopal *Hymnal* (1871); the Baptist *Praise Book* (1871); and the *Methodist Hymnal* (1878) are noteworthy American hymnals.

BIBLIOGRAPHY. It has been estimated that there are at least 400,000 hymns in all languages, of which the greatest number are in German, and the next greatest number are in English. The literature on the subject is consequently becoming quite large. The great thesaurus of information is J. Julian's *Dictionary of Hymnology* (London and New York, 1892), the labor of many years and of many hymnologists. It covers the entire field and contains separate articles upon the hymnology of the different periods and lands. A. F. W. Fischer's *Kirchenlieder-Lexicon* (Gotha, 1878-79) is also very good. For the study of early Greek and Latin hymns the standard work is H. A. Daniel's *Thesaurus Hymnologicus* (Leipzig, 1855), which gives the text of many hymns; for the Latin mediæval hymns, a work of similar rank is F. J. Mone's *Lateinische Hymnen des Mittelalters* (Freiburg, 1853). For German Protestant hymnology to the seventeenth century the great work is P. Wackernagel, *Das deutsche Kirchenlied von der ältesten Zeit bis zu Anfang des XVII. Jahrhunderts* (Leipzig, 1864-77). J. M. Neale, by his *Mediæval Hymns and Sequences* (London, 1851), *Hymns of the Eastern Church* (London, 1862), and other similar works, contributed much to a knowledge of the hymnology of the Eastern and Western Churches of the Middle Ages. A fairly creditable book on Latin hymns is S. W. Duffield's *Latin Hymn-writers and Their Hymns* (New York, 1889).

The following books are recommended, but the list makes no pretension to completeness, only the greater books being named. On the general subject: Josiah Miller, *Singers and Songs of the Church* (New York, 1869); J. E. Prescott, *Christian Hymns and Hymn-writers* (London, 1883); W. G. Horder, *The Hymn Lover* (London, 1889); Duncan Morrison, *The Great Hymns of the Church: Their Origin and Authorship* (London, 1890); A. E. C., *Hymns and Their Stories* (New York, 1894); R. E. Welsh and F. G. Edwards, *Romances of Psalter and Hymnal* (New York, 1896); W. T. Stead, *Hymns that Have Helped* (New York, 1897); Duncan Campbell, *Hymns and Hymn-makers* (London, 1898). For the biography of a hymnologist, consult H. Housman, *John Ellerton: A Collection of His Writings on Hymnology; With a Sketch of His Life* (London, 1896). On German hymnology, consult: Winkworth, *Lyra Germanica* (London, 1855); and id., *Christian Singers of Germany* (ib., 1869); and for the hymns of Luther especially, Bacon, *Hymns of Martin Luther* (New York, 1883). There are several commentaries on hymns that are very well done. Hyde, *Hymnal Sermon Pictures* (New York, 1899), does what is done nowhere else, and is most complete in the analysis of the hymns he discusses. Commentaries on denominational collections are: Biggs, *Hymns, Ancient and Modern* (London, 1867), giving annotations on the hymns of the Church of England; Nutter, *Hymn Studies* (New York, 1884, 3d ed. 1902), based on the American *Methodist Hymnal;* Burrage, *Baptist Hymn Writers and Their Hymns* (Portland, Maine, 1888); Tillet, *Our Hymns and Their Authors* (Nashville, Tenn., 1889); the annotated edition of the *Hymnal* of the Methodist Episcopal Church, South; Robinson, *Annotations upon Popular Hymns* (New York, 1893), based on his *Laudes Domini;* Stevenson, *The* [British] *Methodist Hymn-Book*, illustrated (London, 1883), from which S. W. Duffield drew many of the facts and anecdotes given in his *English Hymns* (New York, 1886), intended as a commentary on Robinson's *Laudes Domini.* The best anthologies of religious lyric poetry are: *The Book of Praise* (London, 1862; many subsequent editions), by Sir Roundell Palmer (Lord Selborne); and *The Treasury of Sacred Song* (London, 1889), by Francis Turner Palgrave.

HYMNS, NATIONAL. See NATIONAL HYMNS.

HYMN TUNES. The authentic history of hymn tunes begins with Hilary of Poitiers, who died in 368. His music was simpler than that of the ordinary jubilations, each syllable of the text being given but one, or, at the most, two musical tones. Saint Ambrose (died 397) and, later, Pope Gregory the Great (died 604), introduced radical reforms in the style and singing of hymns (see AMBROSIAN CHANT; GREGORIAN CHANT), and the impetus given by them to the plain-chant (q.v.) carried that form along for centuries. It is noteworthy that, even so early, in many cases the author of the words also wrote the accompanying melodies. With the growth of polyphonic music these old chants were used as *canti fermi* upon which the more elaborate forms of masses and motets were constructed. Under Palestrina (q.v., died 1594) the polyphonic hymn reached its highest development. Around the historic plain-chants he embroidered a wealth of contrapuntal devices, yet preserving throughout their original smoothness and beauty. The difficulty of the music is the one objection against their more general use.

Meanwhile a reaction had arisen against the heavy, sombre music which had heretofore been the sole style of hymn tunes. Between the acts of Mystery Plays, and especially at those given at Christmas time, it was customary to sing songs whose general trend was religious, but whose music was light and popular. The Reformation was imminent and Luther appreciated and seized the opportunity for an innovation in Church music. He adapted some of these popular tunes to German translations of Latin hymns, wrote some original words, and the whole was set for four, five, or six voices by Johannes Walther. Most important in this connection is the fact that for the first time in the history of hymn tunes the music was rhythmic. This was the beginning of the chorale (q.v.), which became immediately and widely popular. The next great period in Germany begins with Johann Sebastian Bach (1685-1750), who, while emphasizing the rhythmic element, at the same time developed the structural side of the music. After him the decline was rapid.

In France Clément Marot (died 1544) and Theodore Beza (died 1605) wrote metrical psalms which were set to popular music. Goudimel (1505-72), the earliest national composer, wrote many hymn tunes, but their difficulty rendered negative their excellence, and they were supplanted by the simpler arrangements of Claudin le Jeune (died 1600). Of the later French hymn-writers the most important was César Malan, of Geneva (1787-1864), who composed melodies to his own words. In England the history of hymn tunes follows much the same line as on the Continent. There were no hymns proper until the eighteenth century; before that time Tallis (died 1585), Byrd (died 1623), Parsons (died 1570), etc., set psalms to revised forms of old Continental tunes, and in 1621 "the Whole Booke of Psalmes" was published. The music of this edition was arranged largely by Thomas Ravenscroft, the tunes having been set by Bennet, Morley, Tallis, etc. With Orlando Gibbons (1583-1625) the polyphonic school in England came to an end, and the later compositions of Carey (died 1743), Wainwright (1792-1854), and their successors were poor in comparison. The reforms of the Commonwealth did nothing for Church music, and it was not until Purcell (1658-95), the greatest native English composer, that a lighter, more varied note was introduced into hymn tunes. The hymns of Watts (1674-1748) marked the beginning of the popular epoch, and those of Charles Wesley (1757-1834) its high-water mark. In recent years choral music and hymn tunes have drawn more closely together, to the immeasurable advantage of the latter. In England especially, Dykes (1823-76), Barnby (1838-96), Stainer (1840—), and others have all written excellent music. At the same time, however, many hymns have been written in England and the United States whose music depends wholly for its success on its catchy character. Most representative of this class are the hymns of Moody and Sankey. For a more detailed account of hymn tunes, consult: Dickinson, *Music in the History of the Western Church* (New York, 1902), which contains an exhaustive bibliography of the subject; Mees, *Choirs and Choral Music* (New York, 1901); also Butterworth, *Story of the Tunes* (New York, 1890); Love, *Scottish Church Music* (London, 1891); Curwen, *Studies in Worship Music* (London, 1894); Cowan and Love, *Music of the Church, Hymnary and Psalter in Metre, Its Sources and Composers* (London, 1901).

HYND'MAN, HENRY MAYERS (1842—). An English journalist and socialist leader, born in London. He graduated at Trinity College, Cambridge, and began to study law in 1863, but three years later, as correspondent for the *Pall Mall Gazette,* went to the war in progress between Austria and Italy, where he became the friend of Mazzini, Garibaldi, and other patriots. Between 1869 and 1871 he traveled in Australia, New Zealand, and Polynesia, and while in Melbourne wrote articles for the *Argus* in the cause of free education. He founded the Social Democratic Federation in 1881, and from that time was a conspicuous reform agitator. He was chairman at the International Socialist Congress held in London in 1896, and assisted at the formation of the new 'International' at Paris in 1900. He was an Irish land-leaguer and a pro-Boer during the second Boer War. From 1874 he used his pen diligently in the socialistic cause. His books include: *A Commune for London* (1888); *Commercial Crisis of the Nineteenth Century* (1892); and *Economics of Socialism* (1896).

HY'OID BONE (from Gk. *ὑοειδής*, *hyoeidēs*, shaped like the Greek letter upsilon, from *ὖ*, *y*, upsilon + *εἶδος*, *eidos*, shape). The tongue-bone, or V-shaped bone. It is sometimes spoken of as unimportant in man, compared with the so-called hyoid bone in many of the lower animals, in which, on account of its being a support for bronchial apparatus, it is often developed to a great size. But its importance is no less in man, because of its connection with many muscles; the perfection of its form and its exact location at the base of the tongue being a considerable element in the apparatus for the formation of articulate and musical sounds.

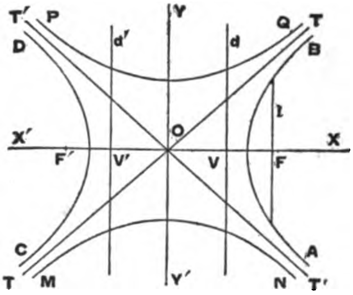
HYOLITHES, hī-ŏl'ĭ-thēz (Neo-Lat. nom. pl., from Gk. *ὖ*, *y*, upsilon + *λίθος*, *lithos*, stone). An important and common fossil of the Cambrian rocks, and found also, though less commonly, in the higher rocks up to and including those of the Permian system. The shells of this mollusk are slender, conical tubes, often curved, and with triangular or flattened cross-sections. Some are provided with a lid to close the aperture. The old genus Hyolithes has been elevated to a family rank, and the numerous species have been distributed among several new genera. The hyolithids are very common in many of the lower Cambrian rocks, and they are indeed among the very oldest fossils known. They have been classed as pteropods, and more recently as worm-tubes, with the probabilities in favor of the latter relation. Some authors have also considered the hyolithids to represent quite nearly the most primitive form of gastropod. Consult: Novak, "Revision der Palæozoischen Hyolithiden Böhmens," in *Abhandlungen der Böhmischen Gesellschaft der Wissenschaften,* series 7, vol. iv. (Prague, 1891); Holm, "Sveriges Kambrisk-Siluriska Hyolithidæ och Conulariidæ," in *Afhandligar Sveriges Geologiska Undersökning,* series C, No. 112 (Stockholm, 1893); Walcott, "Fauna of the Lower Cambrian or Olenellus Zone," in *Annual Report of the United States Geological Survey,* vol. x. (Washington, 1893); Matthew, "Illustrations of the Fauna of the Saint John Group," in *Transactions of the Royal Society of Canada,* vols. i. to v. (Montreal, 1883-91).

HY'OSCY'AMUS. See HENBANE; BELLADONNA.

HYPATIA, hī-pā'shĭ-ȧ (Lat. from Gk. Ὑπατία). Daughter of Theon, an astronomer and mathematician of Alexandria and head of the Neo-Platonic school in that city, early in the fifth century. She is famed alike for her beauty, her purity, her wisdom, and her tragic fate. Her father gave her the best training the philosophy of the time could furnish, and she succeeded him as lecturer at Alexandria; her fame drew students from all parts of the East, where the influence of Greek thought and knowledge was felt. The citizens of Alexandria were proud of her, and such reliance was placed upon her judgment and sagacity that the magistrates used to consult her on important cases. Among those who were most intimate with her was Orestes, prefect of the city. At this time the Bishop of Alexandria was Cyril (q.v.), between whom and Orestes there had arisen a dissension on the question of jurisdiction. "It was commonly reported among the Christians," says Socrates, the Church historian, "that it was by her influence he [Orestes] was prevented from being reconciled with Cyril. Some of them, therefore, whose ringleader was a reader named Peter, hurried away by a fierce and bigoted zeal, entered into a conspiracy against her; and observing her as she returned home in a carriage, they dragged her from it and carried her to a church called Cæsareum, where they completely stripped her and then murdered her with shells. After tearing her body to pieces, they took her mangled limbs to a place called Cinaron, and there burned them." This occurred in March, 415. As at the time Synesius (q.v.) met her (about 395) she had been for twenty years a famous lecturer, and as she lived twenty years after that, she must have been at least sixty years old when murdered, but in legend and fiction she is represented as of unfaded physical charm. She is the heroine of Charles Kingsley's *Hypatia, or New Foes with an Old Face* (1853). Synesius has preserved a few of her letters. Consult Meyer, *Hypatia von Alexandria, ein Beitrag zur Geschichte des Neuplatonismus* (Heidelberg, 1886).

HY'PERÆSTHE'SIA (Neo-Lat., from Gk. *ὑπέρ*, *hyper*, over + *αἴσθησις*, *aisthēsis*, sensibility, from *αἰσθάνεσθαι*, *aisthanesthai*, to perceive through the senses) and HYPERALGESIA. Hyperæsthesia is a term commonly though less correctly used to designate increased sensibility to pain, the proper term being hyperalgesia. It is believed that there is no increase of sensibility to touch or to heat and cold over the normal, though tactile and thermal sensibility may be diminished under various conditions. Unpleasant sensation or actual pain may be caused by a light touch on the surface, and is due to irritation of over-sensitive end-organs of common sensibility (that is, pain), and not to increased perception of touch. Hyperalgesia is due to peripheral, spinal, or cerebral irritation of sensory nerve-fibres. Increased cutaneous sensibility occurs in meningitis, cerebral or spinal; tetanus, hysteria, traumatic neuroses, hydrophobia, etc., as well as neuritis and multiple neuritis, and in some fevers. Local hyperalgesia occurs in inflamed areas, as around carbuncles, burns, gout, etc. See ANÆSTHESIA.

HYPER'BOLA (Gr. *ὑπερβολή*, *hyperbolē*, hyperbola, excess, from *ὑπερβάλλειν*, *hyperballein*, to exceed, from *ὑπέρ*, *hyper*, over + *βάλλειν*, *ballein*, to throw). One of the conic sections (q.v.). Analytically, the hyperbola is the locus of a point which moves so that its distance from a fixed point, called the focus, bears a constant ratio greater than unity to its distance from a fixed straight line, called the directrix. In the figure, F is the focus and d the directrix for the branch on the right; F′ is the focus and d' the directrix for the branch on the left; XX′ is the transverse axis; YY′ the conjugate axis; and l is the latus rectum. The equation of the hyperbola referred to the rectangular axes XX′, YY′ is $\frac{x^2}{a^2}+\frac{y^2}{a^2(1-e^2)}=1$, in which a = OV, and e is the given ratio. Since $e>1$, $a^2(1-e^2)$ is negative. Putting $-b^2$ for this negative quantity, the standard form of the equation is $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$. The curve MN, PQ is the *conjugate hyperbola* with reference to the hyperbola AB, CD. (See CONJUGATE.) The hyperbola is the only conic section having real asymptotes. These are the lines TT, T′T′ in the figure. The equation of the hyperbola referred to its asymptotes is $xy=ab$. An hyperbola whose asymptotes are perpendicular to each other is called a *rectangular* or *equilateral hyperbola*. These asymptotes have the following remarkable property: If, starting from O, the asymptotes be divided in continued proportion, and from the points of section lines be drawn parallel to the other asymptote, the areas contained by two adjacent parallels and the corresponding parts of the asymptote and curve are equal.



HYPERBOLA.

HYPERBOLE, hī-pẽr'bō-lē. The name given to a figure of rhetoric, by which expressions are employed that, taken literally, signify more than is really meant. The use of the figure is to arrest the attention. Hyperbole is the basis of many metaphors. Thus, we call Nero a 'monster'; Tamerlane, a 'tiger'; and so on. See RHETORIC, FIGURES OF.

HYPERBOLIC LOG'ARITHMS. See LOGARITHM.

HY'PERBO'REANS (Gk. Ὑπερβόρεοι, *Hyperboreoi*, beyond the north wind, from ὑπέρ, *hyper*, beyond + βορέας, *boreas*, north wind). A name given by the ancients to a mythical people dwelling in the distant north, beyond the Rhipæan Mountains, where it was everlasting day and perpetual spring, and where sorrow and old age were never found. The name was often applied to any people who lived in the far north. The Hyperboreans may have been originally those who brought to Apollo gifts and sacrifice. Consult Crusius, "Hyperboreer," in Roscher, *Lexikon* (Leipzig, 1884-97).

HY'PERCAL'VINISM. That form of Calvinism which carries the system to its extreme logical conclusions, holding, for example, to a double predestination (to evil as well as good), and atonement only for the elect. The more moderate Calvinists seek to soften some of the results of their principles.

HYPER-GEOMETRY. See GEOMETRY, section *Hyper-Geometry*.

HY'PERI'DES (Lat., from Gk. Ὑπερείδης, *Hypereidēs*). An Athenian orator of the fourth century B.C., one of the ten comprised in the Alexandrian canon. After studying philosophy under Plato, and oratory under Isocrates, he began his public career as an advocate in the Athenian courts of justice, and joined the patriotic party, at that time led by Demosthenes and Lycurgus. He fitted out two triremes at his own expense for the Eubœan expedition of B.C. 358. In B.C. 338, when the disastrous fight of Chæronea laid Greece at the mercy of Philip, Hyperides proposed that the citizens should send their wives and children to places of security, and fight it out to the last. Though this desperate advice was not taken, its genuine patriotism was appreciated and rewarded by his countrymen. When the death of Philip revived the hopes of the anti-Macedonian faction, Hyperides promoted the alliance with Thebes, and after the destruction of that city by Alexander was one of the orators demanded of the Athenians by the Macedonian king. Alexander, however, did not press his demand, and Hyperides continued to oppose the Macedonian influence as strongly as ever. The arrival in Athens of Harpalus, the runaway treasurer of Alexander, then absent on his Eastern conquests, disturbed the friendly relation that had hitherto subsisted between Hyperides and Demosthenes, for in this celebrated case Hyperides, as one of the few anti-Macedonians who were above suspicion, was chosen to prosecute his friend. (See DEMOSTHENES.) In the Lamian War, which followed the death of Alexander, Hyperides took a leading part, and he spoke the funeral oration over his countrymen who had perished in battle. The year B.C. 322 saw the hopes of Athens finally crushed at the battle of Crannon. The chiefs of the patriotic party sought safety in flight. Hyperides was overtaken at Ægina and put to death. Tradition says that his tongue was torn out by his captors, or that he bit it out to avoid betraying his friends. As an orator Hyperides was ranked high by the ancients; it is said that some critics preferred him to Demosthenes. The 'grace' of his speeches was especially praised. The writer of the *Lives of the Ten Orators* enumerates 75 speeches, of which 52 were considered genuine. Until recently these were known only in scanty fragments, but late in the last century a number of papyri were discovered in Egypt which contain six speeches in a fairly complete state, including the famous funeral oration. This fully justifies the praise of the ancient critics, and may be ranked as one of the finest products of Greek oratory. A complete edition of the speeches and fragments has been published by Blass (Leipzig, 1894). The orations *Against Athenogenes* and *Against Philippides* have been edited, with an English translation, by Kenyon (London, 1893). Consult: Blass, *Attische Beredsamkeit*, iii (Leipzig, 1898); Jebb, *Attic Orators*, ii. (London, 1880).

HYPE'RION. See TITANS.

HYPERION. (1) A poetic fragment by John Keats. It deals with the overthrow of the old order of Saturn by the new one of Jupiter in Greek mythology, was begun in 1818, recast but by no means for the better in 1819, and finally published in 1820. (2) A romance by Longfellow, published in 1839. Its sale during the first twenty years approximated 15,000 copies. It narrates the wandering through Germany of Paul Flemming, the partly autobiographical hero, and contains much of German romance, introduced by translations of legends and poems.

HYPE'RIUS, ANDREAS GERHARD (1511-64). A Protestant theologian and reformer, born at Ypres, whence his learned name Hyperius, Gerhard being his family name. He was educated at the University of Paris, and traveled in the Netherlands and in Germany. Driven from England (where he lived four years with William Mountjoy, Erasmus's friend) by the persecutions of 1540, he went to Germany, was converted to Protestantism, and became professor of theology at Marburg. A deep scholar and a liberal theologian, he was accused of Zwinglian views on the Lord's Supper. He wrote: *Methodi Theologiæ Libri III.* (1566); *De Formandis Concionibus Sacris* (1553); and *De Recte Formando Theologiæ Studio* (1556), the first scientific dictionary of theology.

HY'PERMET'AMOR'PHOSIS. See METAMORPHOSIS.

HY'PERMETRO'PIA. See SIGHT, DEFECTS OF.

HY'PERMNES'TRA (Lat., from Gk. Ὑπερμνήστρα). One of the Danaids. She alone of the daughters of Danaüs disobeyed his command to slay her husband, Lynceus, but was eventually pardoned by her father.

HY'PERO'PIA (from Gk. ὑπέρ, *hyper*, above + ὤψ, *ōps*, sight). A congenital or acquired error of refraction of the eye. Owing to too little convexity of the refracting surfaces, parallel rays of light do not converge to a focus on the retina, like in the normal eye, but to a point somewhere behind the same. It is usually called Hypermetropia, long-sightedness, and is the opposite of myopia.

HY'PERSPACE. See GEOMETRY.

HY'PERSTHENE (from Gk. ὑπέρ, *hyper*, over + *σθένος*, *sthenos*, strength). An iron-magnesium silicate. It crystallizes in the orthorhombic form, but is also found in granular masses. Associated with labradorite and other basic feldspars, it is an important constituent of certain eruptive rocks, such as gabbro and norite, and is widely distributed, especially in Sweden, Norway, Greenland, the Adirondacks, and Canada. When cherry-red in color·it may be cut and polished, and used as an ornamental stone.

HYPERSTHENE GAB'BRO. See GABBRO.

HYPER'TROPHY (from Gk. ὑπέρ, *hyper*, over + τροφή, trophē, nourishment, from τρέφειν, *trephein*, to nourish). The term applied in medicine to the abnormal and disproportionate enlargement of any part of the body. Examples of this change are seen in the muscular system, where it may occur altogether independently of disease. The huge bosses of flesh that stand prominently forward in the arm of a blacksmith or of a pugilist, and in the leg of a ballet-dancer, are illustrations of hypertrophy from increased use, where the general health may be perfect. In double organs, such as the kidneys and lungs, if the organ on one side degenerates through disease, the organ on the opposite side is often found to enlarge, and carry on double work. In these cases hypertrophy is an effect of disease, but is at the same time a preservative of life.

There are, however, cases in which the hypertrophy has a hurtful instead of a conservative effect, as, for example, hypertrophy of the thyroid gland, constituting the disease known as goitre or bronchocele, hypertrophy of the prostate gland, of the spleen, etc. The following are the etiological factors of hypertrophy: (1) It may be congenital. (2) A local increase in the supply of blood to a part, whether due to increased exercise, or irritation by mechanical or chemical agents, etc. (3) It may be due to old age—the so-called senile hypertrophy, the commonest example of which is the enlargement of the prostate gland in old men, which is said to occur in about forty per cent. of all men after the age of fifty years. (4) Syphilis and chronic inflammations are also very common causes of hypertrophy. See Heart, Diseases of the.

HY′PHA (Neo-Lat. nom. pl., from Gk. ὕφη, *hyphē*, web). An individual filament of the body of a fungus. A mass of organically related hyphæ constitutes a mycelium. See Fungi.

HYP′NAL (from Gk. ὑπναλέος, *hypnaleos*, causing sleep, from ὕπνος, *hypnos*, sleep; connected with Lat. *somnus*, *sopor*, AS. *swefen*, Skt. *svapna*, sleep, from *svap*, to sleep). A hypnotic of unquestionable value, combining as it does the effects of chloral hydrate and antipyrine, of which it is composed. Although it is recommended by some for insomnia accompanied by coughing, its chief use is found in cases of sleeplessness due to pain. Its only rivals in the latter field are opium, chloral hydrate, and Cannabis Indica. (See Hashish.) The objections to using opium as a hypnotic in cases of persistent sleeplessness are well known; and the combination of the analgesic antipyrine with chloral hydrate gives great relief from pain, permitting the hypnotic action of the latter drug.

HYP′NOS (Lat., from Gk. Ὕπνος). The Greek god of sleep, the son of Erebus and Night, and twin brother of Death. He is represented as a youth with wings on his temples, bearing a poppy branch and the horn of slumber.

HYP′NOSCOPE (from Gk. ὕπνος, *hypnos*, sleep + σκοπεῖν, *skopein*, to view). A magnet devised to measure hypnotic sensitiveness. The magnet is a slit tube 3.4 cm. in diameter by 5.5 in length, and weighs 169 grams. It is very powerful, lifting 25 times its own weight. The instrument is applied by removing the armature and inserting the forefinger of the person to be tested into the magnet so as to touch both poles at once. After two minutes sensitive or objective effects will be noticed in 30 per cent. of persons tested. It is not an instrument of any value whatever. Hypnotic influences cannot be measured by any known mode at the present time.

HYPNOTICS (from Lat. *hypnoticus*, Gk. ὑπνοτικός, *hypnotikos*, relating to sleep, from ὕπνος, *hypnos*, sleep). Agents which are used to induce sleep. During the state of slumber, especially if deep, the functional activity of the cerebral centres is largely suspended. Medullary centres remain active, but are less alert. The brain and spinal cord are anæmic, reflex action is diminished, and the senses are dulled. The ordinary precautions of one about to sleep—the recumbent position, the darkened and quiet room, the absence of previous excitement—are simply evidences of physiological necessity. Hypnotics act ordinarily by diminishing the functional activity of the brain, or by causing an anæmia of it, occasionally by both methods. They may be divided into four classes: (A) *Mental*, acting by diminishing the functional activity of the cerebrum. This class includes the constant repetition of prayers, etc., the counting up into the hundreds or thousands, the counting imaginary sheep as they jump an imaginary wall, and many similar expedients. These are only of value in light grades of insomnia. (B) *Dietetic*. This class causes a congestion of the abdominal viscera by increasing their functional activity, and thus leads indirectly to cerebral anæmia. A light supper of crackers and cheese, or oysters, or soup, or beef tea, is often of great value for inducing sleep. Frequently the addition of a little alcohol as a weak toddy, or a bottle of beer, will help. (C) *Mechanical*, including: (1) *Hot water-bag* or *brick* to the feet, of value when the extremities are cold. It acts by indirectly causing cerebral anæmia. (2) *Moist warmth* to abdomen by a poultice or hot compress covered with oil-silk. This is frequently of value. It acts by dilating the abdominal vessels, and this causes cerebral anæmia. (3) *Hot bath*. This acts by dilating the cutaneous vessels, and thus causing cerebral anæmia. Certain precautions should be observed: The bed should be well warmed, and the room moderately cool. The bath should be hot, and the individual should stay in it for several minutes. He should be dried as quickly as possible, and in passing from the bath to the bed he should be well wrapped up and wear warm slippers. This method is often of great value when properly applied. It should be used with caution in cases of heart disease. (4) *Chapman's method*. This consists in the application of cold to the spine. It indirectly causes dilatation of the abdominal vessels, and thus cerebral anæmia. (5) *Massage*. This should be general and thorough, especially to the abdomen. It acts by dilating the vessels of the body, and also by lessening the irritability of the sensory cutaneous nerves. If the ordinary precautions of quiet and darkness are observed after the massage, this method frequently acts very well. All the preceding measures are of little value in case any acute disease is present. In such cases, and many others, we have to resort to drugs. These should not be used for ordinary insomnia until a thorough trial has been given to the dietetic and mechanical hypnotics. None should be given except under the advice of a physician who has examined the patient. They are, of course, grouped under the class (D) *Medicinal*. (1) *Opium* and its derivatives. As simple hypnotics these are all objectionable, for they produce other marked effects than sleep. The danger of a habit forming must also be considered. In acute diseases, especially when accompanied by pain or delirium, they are of great value. Codein is the least objectionable, but it is also the most expensive and the least efficacious. Heroin, dionin, and peronin, three new derivatives of morphine, can be utilized, but the danger of forming a habit is always present. (2) *Hyoscyamus* and its derivatives. These are not of as much value as are ordinary hypnotics, for they cause other marked effects. In cases of mania they are of great value. Hyoscine hydrobromate has the most decided hypnotic action. (3) *Cannabis Indica*. Feeble in hypnotic power. The sleep produced by it is apt to be preceded by delusions often unpleasant. (4) *Chloral hydrate*. This is a very valuable hypnotic. It has some objections. A very important one is the tendency to the formation of a habit. Another is the difference in susceptibility to its action. Chloral hydrate is a powerful cardiac depressant, and in cases of heart disease or heart weakness from any cause, it should be used with great caution, if at all. A small dose has caused death, although fifty and sixty grains have been given in other cases without harm. (5) *Bromides.* These are not very powerful hypnotics, but are often used as adjuvants to others. Potassium bromide is the most useful, but sodium bromide, though less active, is not as depressing to the circulation. (6) *Monobrated camphor.* A feeble hypnotic. (7) *Paraldehyde,* a polymeric modification of acetic aldehyde. This is an efficient hypnotic, producing sleep, as a rule, in half an hour. As regards its nervous effects, it is almost a pure hypnotic, and it causes but slight depression of the heart and respiration. It leaves no after effects except the odor of the breath, which is often very marked. It may cause nausea or vomiting if the stomach is very irritable. Like all hypnotics, it sometimes fails. (8) *Sulfonal.* This is an efficient but slow-acting hypnotic. The dose is given one or two hours before the expected sleeping-time. (9) (10) *Trional* and *Tetronal* are similar drugs, with more rapid and powerful action. The three last named may produce poisoning if used for any length of time or in too large doses. (11) Urethane, ethyl, $C_2H_5CO_2NH_2$, has a bitter, disagreeable taste. This is an efficient hypnotic, leaving no disagreeable after effects. In large doses it may cause vomiting, but is otherwise a pure hypnotic. It has no depressing action on the heart or respiration. (12) *Amylene hydrate.* A colorless fluid with a sharp taste and smell. This is an efficient hypnotic, causing sleep in fifteen to forty-five minutes. The sleep is natural, and there are no bad after effects. It has no depressing effects on the heart or respiration. It has caused in a few cases a delirium resembling that of alcoholic intoxication, but followed by refreshing sleep. (13) *Amylene chloral,* or dormiol, is similar in action. Most of the drugs named are considered in special articles under their names.

HYPNOTISM, or **HYPNO'SIS** (from Gk. ὕπνος, *hypnos,* sleep). The general names for a group of abnormal phenomena, physical and psychical, which show a close outward resemblance to the phenomena of normal sleep and of sleep-walking. The symptoms of the hypnotic state differ considerably among different subjects, and the marking off of distinct stages within this state is rather a matter of theory than of actual observation. The artificial sleep is continuous and progressive, beginning with a languor and drowsiness not unlike those of a man suddenly waked from sound sleep, or arousing from a too protracted morning's nap after a disturbed night. As the state advances, the subject becomes partially anæsthetic, insensitive to pin-pricks, pinching of the skin, etc.; his sense-organs are closed to most of the impressions from his surroundings that would normally excite them; if awakened before the sleep has grown more profound, he remembers hazily what has occurred during hypnosis. He is extremely suggestible at the hands of those who, as he thinks, have induced the sleep, and will execute movements that the experimenter prescribes to him. The voluntary muscular system evinces a curious rigidity and fixity; the subject will remain in any position in which he is placed. This feature has given the name of 'catalepsy' (seizure) to the stage in question. As the sleep is continued the subject becomes still more anæsthetic, until consciousness seems to lapse altogether; on waking, he has no memory whatsoever of the hypnotic period. The name of 'somnambulism' is given to a stage of profound hypnosis in which illusions are produced at the experimenter's suggestion: the subject takes ink for wine, a pillow for a baby, steps carefully over an imaginary book, etc., etc.

These phenomena of sleep or trance, mixed with much that is simply charlatanry, have been discussed and exploited from time immemorial. The medicine-men of primitive and savage tribes, the magicians of Egypt and Chaldæa, the Hindu ascetics, the monks of Mount Athos, the quack physicians of all ages, have made use of hypnotism to enhance their personal prestige, to cure the sick, or to induce states of religious ecstasy. The modern history of hypnotism begins with F. A. Mesmer (1733-1815), a German physician who practiced hypnotic therapeutics at Paris from 1778, causing so great a stir in scientific circles that his pretensions were made a matter of inquiry by a royal commission (1785). The report of the commission was unfavorable; but 'mesmerism' still flourished. In England valuable works were published in the early forties by J. Braid, a Manchester surgeon (c. 1795-1860); but their sanity and importance have but recently been fully recognized. Braid coined the word 'neurohypnotism,' or nerve sleep, from which comes the modern word hypnotism. During the last third of the nineteenth century the facts of hypnosis were thoroughly investigated by physiologists and psychologists. Heidenhain and Preyer in Germany, Richet, Charcot, Liébault, and Bernheim in France, Delbœuf in Belgium, confirmed and extended Braid's results. The French investigators split into two distinct 'schools': that of Charcot and his followers at the Paris Hospital of the Salpêtrière, and that of Bernheim and his followers at Nancy. The Salpêtrière school maintains that hypnotism is a pathological phenomenon, akin to hysteria, and characterized by three well-marked stages; the school of Nancy asserts that it can be set up in the normal individual, that it is a unitary and progressive stage, and that the key to its understanding is given with the facts of suggestion. The latter views have found general acceptance; but the controversy undoubtedly hindered the advance of knowledge and threw discredit upon the whole subject. It need hardly be said that the doctrines known as animal magnetism, electro-biology, odism or odylism, mesmeric clairvoyance, etc., are one and all—save in so far as they cover the facts of hypnotism proper—fanciful and ungrounded hypotheses.

In considering the psychology of the hypnotic state, we have first to notice that its sole and essential condition is an exaggerated state of passive attention to some object or person. (See ATTENTION.) In popular phraseology there is a 'total surrender of the will' of the subject, either to a sense-impression or to the experimenter's personality. The condition of hypnosis thus lies—and this fact is of extreme importance—in the mind of the subject himself; the experimenter or 'operator' has no power, except as the subject gives him power. The reason that the professional hypnotist and the physician are accredited with a special ability to induce hypnosis is, first, that they 'suggest' to the inquirer—whether consciously, by strongly worded advertisement, or unconsciously, by the mere authority of position—that such ability resides in them; and, secondly, that they acquire, in the course of their experience, a tact or insight concerning the best means of bringing the inquirer into the necessary attentive state. The subject comes to them prepared for hypnotization; and they make conditions easy for its attainment. Further than this the ability of the operator does not extend. It is, indeed, entirely possible to hypnotize one's self. (See AUTOSUGGESTION.) Most of us have, at times, 'let ourselves go' mentally, until we were on the verge of what seemed to be a kind of fascination or trance, at the brink of which we aroused ourselves with a start. If now we place ourselves under circumstances favorable to sleep, cutting off, so far as may be, external impressions, and attend concentratedly to the idea of hypnosis, we presently drop into a similar state of 'fascination' which soon becomes hypnosis proper, and later passes off as ordinary sleep.

We notice, secondly, as a corollary to what has just been said, that all persons of normal constitution are hypnotizable. Hypnosis is 'abnormal' only in the sense in which dreaming (q.v.) is abnormal; and as we are all liable, though in varying degree, to dreams, so are all normal minds liable to hypnotization. The strong-minded person who declares that So-and-so tried to hypnotize him, but could not on account of his vigorous resistance, makes a ludicrous misstatement. It is not So-and-so who is to hypnotize him, but he himself; and incapacity for hypnosis is not the mark of a strong, but of a weak mind. Hypnosis (and this is a difference between it and dreaming) is impossible in the case of idiots and of very young children, because they are scatter-brained, unable to attend fixedly and continuously; the more 'powerful the will,' the easier must hypnosis be. We see this, indeed, in the tendency of vigorous minds to 'brown study,' a state nearly related to hypnosis, and characterized by the same single-hearted absorption, and the same arrest of bodily movement. Whether or not animals can be hypnotized is a disputed question. In the emotion of extreme fear (when, if ever, the animal mind must be dominated by one sole idea, and so approach to the requisite degree of passive attention), we have a muscular rigidity, known as 'cataplexy' (cf. the popular word 'stroke'), which outwardly resembles the stage of catalepsy in man. Seize a frog firmly by a hind leg, and the animal will spread out, stiff and stark, making no effort to escape. Pigeons, fowls, guinea-pigs, etc., can all be readily 'hypnotized' by similar means. The trend of expert opinion seems, however, to be that the resemblance to hypnosis is rather external than real.

We turn now to some special questions of hypnosis, and first (1) to that of the *rapport*. This is a supposed subjective link or bond whereby the experimenter, in virtue of his will-power or personal magnetism, attaches the subject to himself. Now it is true that there are cases in which a subject can be 'hypnotized' only if a certain operator or experimenter allows or commands it. But there is nothing mysterious, still less supernormal, in the matter. The subject in some way (perhaps by self-suggestion, perhaps at the explicit suggestion of a physician) acquires the insistent belief that hypnosis is impossible for him without the presence or assent of the experimenter; and the belief, once acquired, is effective. It is thus the subject, again, whose 'will' is concerned, not the operator. The *rapport* is sometimes suggested by physician to patient, in order to prevent interference by outsiders with the conduct of a case; and thus serves a useful purpose. (2) It may be suggested to a somnambulistic subject that at such-and-such a time after waking from the hypnotic sleep he shall perform such-and-such an action. This is termed *post-hypnotic* or *terminal* suggestion. Its effectiveness depends upon the fact that the time idea is common both to the hypnotic and to the waking consciousnesses, and so forms a bridge between the abnormal and the normal states. "You will go into the kitchen and drink a glass of water at five o'clock." The subject is strongly impressed by the five-o'clock idea. When, therefore, five o'clock actually comes, its perception or idea is sufficient to throw him into the first stage of hypnosis; the suggestion recovers its hypnotic strength, and he goes, passively, to execute the prescribed act. (3) Although the somnambulist remembers nothing of the hypnotic state from which he is aroused, he may, if rehypnotized, recall what took place during his previous sleep. Memory is thus continued from one hypnotic consciousness to another, as it is from one waking consciousness to another; but there is no continuity of memory from sleep to waking, or vice versa. This fact has given occasion to various theories of double consciousness (q.v.): quite unnecessarily—for it is adequately explained by the known laws of memory. We remember only when we have a cue to memory, when our present circumstances 'suggest' the past. When eating a good dinner after a long walk we recall other good dinners eaten in like circumstances; we do not recall such dinners when there is nothing to remind us of them. But the waking state, with all the sudden inrush of stimulations that it involves, is entirely different from the hypnotic state; there is nothing in the one (apart from the terminal suggestions just discussed) to remind us of the other: whereas there is everything in a present hypnotic state to revive our memories of foregone like states. Dreams, in the same way, are not seldom continued from night to night, though we forget all about them in the daytime. (4) Lastly, as regards the *therapeutic value* of hypnosis, we may say that as a 'suggestion,' in the waking life, may make us blush or cry, so may the indefinitely stronger suggestions of the hypnotic state bring about circulatory or secretory changes that are of benefit to the organism. But no command to get well can ever mend a broken bone, or cure a typhoid patient. Moreover, there is always the danger of setting up an 'hypnotic habit,' or of breaking down the subject's self-reliance; in which event the remedy is worse than the disease.

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HYPOBOLE, hī-pŏb′ō-lē (Gk. ὑποβολή, a throwing under, from ὑπό, *hypo*, under + βάλλειν, *ballein*, to throw). A figure of rhetoric, whereby each of several arguments that appear to favor the side of one's opponent is introduced only to be refuted in order. See Rhetoric, Figures of.

HYP'OCAUST (Lat. *hypocaustum, hypocauston*, from Gk. ὑπόκαυστον, vaulted room with furnace below, from ὑπό, *hypo*, under + καυστός, *kaustos*, burned, from καίειν, *kaiein*, to burn). The name for the subterranean hot-air chamber under the *calidarium* in Roman bathing establishments. The hot air was generated by a circular furnace which heated the water and gave out streams of hot air into the hypocaust, which consisted of a hollow double floor of concrete and tiles, between which were the pillar-like *suspensuræ* of tiles. The hot air was distributed throughout the building from the hypocaust by series of wall and floor flues, giving an even temperature. The system was invented shortly before Augustus, and was soon adopted not only in public baths, but in private houses. It is now coming again into use for heating the so-called 'Turkish baths.' It can be studied in all the details of its arrangement in the ruins of Roman houses and baths. See Baths.

HY'POCHLO'RITES. See Hypochlorous Acid.

HY'POCHLO'ROUS ACID, $HClO$. An acid that may be assumed to be formed when chlorine monoxide (Cl_2O) is dissolved in water. Chlorine monoxide, which decomposes into chlorine and oxygen with explosive violence, may be obtained by the action of dry red oxide of mercury upon chlorine. In aqueous solution, chlorine monoxide is not explosive. The salts of hypochlorous acid are termed *hypochlorites*, and some of them are valuable bleaching agents. Ordinary bleaching-powder is supposed to contain the hypochlorite of calcium; Javelle water contains the hypochlorite of potassium; Labarraque's solution contains the hypochlorite of sodium. Bleaching-powder is made by the action of chlorine on lime; similarly, the hypochlorite of potassium may be obtained by the action of chlorine upon a cold solution of caustic potash. If solutions of hypochlorites are heated, the corresponding *chlorides* and *chlorates* are formed. See Bleaching-Powder.

HYPOCHŒRIS, hī′pō-kē′rĭs (Neo-Lat., from Gk. ὑποχοιρίς, succory-plant). A genus of plants of the natural order Compositæ, of which one species, *Hypochœris radicata*, or long-rooted cat's-ear, is extremely common in meadows and pastures in Great Britain and other parts of Europe. Its leaves, which are all radical, and spread on the ground, resemble in form those of the dandelion, but are rough; the stem is branched, the flowers somewhat similar to those of the dandelion, but smaller. Cattle eat this plant readily, and its abundance is not deemed injurious to pasture or fodder.

HYPOCHONDERS, hī′pō-kŏn′dẽrz, or **HYPOCHONDRIA** (from Lat. *hypochondrium*, Gk. ὑποχόνδριον, soft part of the body below the cartilage and above the navel, from Gk. ὑπό, *hypo*, under + χόνδρος, *chondros*, cartilage). An old term for the two lateral and superior regions of the abdomen (q.v.) under the cartilages of the false ribs, and to the right and left of the epigastrium.

HYPOCHONDRIA, hī′pō-kŏn′drĭ-ȧ. See Hypochonders; Hypochondriasis.

HYP'OCHONDRI'ASIS (Neo-Lat., from Lat. *hypochondrium*, Gk. ὑποχόνδριον, hypochondriac region; so called because of the supposed connection of the disease with this part of the body). A disease characterized by extreme increase of sensibility, palpitations, morbid feelings that simulate the greater part of diseases, exaggerated uneasiness, and anxiety, chiefly in what concerns the health, etc. In extreme cases it becomes a species of insanity. The disease is very frequently associated with disorder of the digestive functions.

When sombreness of disposition and anxiety concerning personal comfort become exaggerated, and attention is directed chiefly to the state of the health, it amounts to common hypochondriasis. When it passes beyond the control of the will, when the whole mind is directed to the state of the system, or to particular organs, and exalts and misinterprets sensations, the condition is designated hypochondriacal insanity. The disease may be described as the engrossment of the attention by false impressions conveyed, or conceived to be conveyed, from internal organs. These sensations may, in many instances, be real, and proceed from actual alterations in the structure or functions of the parts supposed to be affected; but they may likewise consist of ordinary sensations, excited and intensified by the act of attention which makes them known to the patient. Neither the experience nor the sufferings of the victims are imaginary, however absurd their errors, and however groundless their apprehensions may be; the disease is real, and consists in the exaltation of sensibility and attention, and in the delusions which originate in that morbid state. A man lives in constant fear of death; he is firmly convinced that he labors under cancer, consumption, disease of the heart, etc. Hypochondriasis is often a precursor of melancholia, or other kinds of alienation; but it must likewise be regarded as a distinct and independent affection, traceable, generally, to disorder of the digestive and assimilative apparatus, to sexual excess or other debilitating influences. Such patients always should be watched, for many of them commit suicide while temporarily under the influence of an hallucination or a delusion. Diversion, camp life, hunting, fishing, and other occupations should engross the patient's attention during an outdoor life, or travel should be his resource, always in the society of a lively, healthy companion. Drugs alone produce little benefit. Consult: Falret, *De l'hypochondrie et du suicide* (Paris, 1822); Bucknill and Tuke, *Psychological Medicine* (London, 1879); Mercier, *Psychology, Normal and Morbid* (London, 1902).

HY′POCOTYL (abbreviation of *hypocotyledonous*, from Gk. ὑπό, *hypo*, under + κοτυληδών, *kotylēdōn*, cotyledon, from κοτύλη, *kotylē*, socket). In seed-plants, the axis of the embryo below the cotyledons. This axis has been variously called 'radicle' and 'caulicle,' but since it has peculiar powers which do not belong to ordinary root and stem structures, it has received a distinctive name. See EMBRYO.

HYPOCRITE, THE. A play by Isaac Bickerstaffe, produced in 1768, and founded on Cibber's *Non-Juror*, which, in turn, was taken from the *Tartufe* of Molière.

HY′POCY′CLOID. See CYCLOID.

HY′PODER′MIC MEDICATION (from Gk. ὑπό, *hypo*, under + δέρμα *derma*, skin). Introduction of medicines beneath the skin, with a hypodermic syringe. This method is often preferable to that of giving them by the mouth. The stomach is sometimes in a condition which will not bear the presence of drugs, particularly narcotics, and these are the agents which are most frequently administered hypodermically. A small graduated glass syringe attached to a slender hollow needle, cut off obliquely so that its sharpened extremity may easily be made to pierce the skin, is used. The medicine may be thrown in just beneath the skin, or the point of the syringe is thrust into the body of a muscle. The wounding of blood-vessels or nerves should be carefully avoided, and therefore the operation should not be undertaken except by a physician or a trained nurse. Local pains may generally be more successfully treated in this manner than by the common method. In some cases an anæsthetic may, however, be preferable. It is usual to make a special preparation of the drug which is to be introduced. The syringe must be completely filled when used, as the introduction of an air-bubble into a vein might be attended with danger. All instruments and drugs used should be thoroughly sterilized. The hypodermic syringe should be used with great caution, and never by the patient.

HY′PODER′MIS (Neo-Lat., from Gk. ὑποδερμίς, under-skin, from ὑπό, *hypo*, under + δέρμα, *derma*, skin). In plants, a layer of cells beneath the epidermis. An archesporial cell is said to be hypodermal in origin when it arises immediately beneath the epidermis. Tissues bordering directly upon the epidermis are called *hypodermal*.

HYPOGYNY, hī-pŏj′ĭ-nĭ (from Gk. ὑπό, *hypo*, under + γυνή, *gynē*, woman). The condition in a flower in which the sepals, petals, and stamens arise from beneath the ovary. As a consequence, the ovary is seen inside of the flower, and is often spoken of as 'superior.' The contrasting term is 'epigyny' (q.v.). Hypogynous flowers are considered to be more primitive in character than epigynous flowers. See FLOWER.

HY′PONASTY (from Gk. ὑπό, *hypo*, under + ναστός, *nastos*, close-pressed, from νάσσειν, *nassein*, to pack closely). A term applied by De Vries to the occurrence of greater growth upon the under side of a dorsiventral organ, which produces therefore an upward curvature. This may be due to internal or external causes. It is the common condition of young leaves and flower parts when in the bud. The correlative term is epinasty. See GROWTH (in Plants).

HY′PONI′TRITES. See HYPONITROUS ACID.

HY′PONI′TROUS ACID, $H_2N_2O_2$. An acid which may be obtained in dilute aqueous solution, or in the form of its salts, but which has not been isolated in a concentrated state. Its salts are termed *hyponitrites*. It may be obtained by allowing sodium amalgam to act upon barium nitrite, neutralizing the resulting solution with acetic acid, precipitating with silver nitrate, and decomposing with hydrochloric acid the silver hyponitrite thus obtained. Silver hyponitrite, $Ag_2N_2O_2$, explodes if heated to a moderately high temperature. The solution of free hyponitrous acid decomposes, on heating, into nitrous oxide ('laughing gas') and water.

HY′POPHOS′PHITES. See HYPOPHOSPHOROUS ACID.

HY′POPHOS′PHOROUS ACID, H_3PO_2. A crystalline compound that melts at about 17.5°C. and is readily transformed into ordinary phosphoric acid. It may be obtained by boiling caustic potash with phosphorus, subsequently adding sulphuric acid, concentrating the solution by evaporation and allowing it to crystallize in the cold. The salts of hypophosphorous acid are termed hypophosphites, those of iron, calcium, sodium, and potassium being extensively used in medicine, and often forming ingredients of patent medicines which are claimed to be valuable remedies for tuberculosis. Most such preparations are worthless, being mixtures of the hypophosphites of two or more metals, the several ingredients of which may counteract one another; and some such mixtures are positively harmful. On the other hand, if prescribed separately, in moderate doses, by a competent physician, the hypophosphites often constitute valuable therapeutic agents, inasmuch as they have the effect of improving nutrition and relieving some of the symptoms of phthisis. The hypophosphite of potassium may be used as an expectorant in chronic bronchitis. The officinal syrup of hypophosphites contains several hypophosphites, a considerable amount of free hypophosphorous acid, and often some iron.

HYPOS′TASIS (Neo-Lat., from Gk. ὑπόστασις, *hypostasis*, subsistence, from ὑπόστατος, *hypostatos*, substantial, from ὑφιστάναι, *hyphistanai*, to stand under, from ὑπό, *hypo*, under + ἱστάναι *histanai*, to stand). A term of Greek theology, variously employed before the fourth century, but at last technically used to denote personal distinctions in the Godhead. The Council of Nicæa (325) did not clearly distinguish between *hypostasis* and *ousia* (substance and essence), and a controversy followed. (See HOMOOUSION.) The same uncertainty appears in the West as late as Augustine, who confesses that he does not understand the difference between the two Greek words (*De Trinitate*, v. 8, 10). But gradually the two words were differentiated, and *hypostasis* came to be used exclusively for the personality of Father, Son, or Holy Spirit. It was thus interpreted as being equivalent to *prosopon*, which the Latin rendered by *persona*, whence our word 'person.' The fully developed trinitarian dogma asserts one essence, or substance (*ousia*), and three persons (*hypostasis*) in the Godhead. This has remained the orthodox faith of the Church. Consult: the *Histories of Doctrine*, by Harnack, vol. iv. (London, 1898);

Loofs (Halle, 1893); and Fisher (New York, 1896). See TRINITY, DOCTRINE OF THE.

HY'POSTAT'IC UNION. A term used to describe the union of Christ's human nature to the hypostasis or person of God the Word, in virtue whereof, while each nature is complete, even after union, yet there is but one undivided person of the God-man, to which all the actions, whether divine or human, are ascribed. This form of expression was devised for the purpose of excluding the doctrine of a mere moral union held by Nestorius. See MONOPHYSITES; NESTORIANS; TRINITY, DOCTRINE OF THE.

HY'POSUL'PHITES. See THIOSULPHURIC ACID.

HYPOT'ENUSE (Fr. *hypoténuse*, from Gk. ὑποτείνουσα, *hypoteinousa*, subtending, from ὑποτείνειν, *hypoteinein*, to subtend, from ὑπό, *hypo*, under + τείνειν, *teinein*, to stretch). That side of a right-angled triangle opposite to the right angle. The hypotenuse is the longest side of the triangle, and its mid-point is the centre of the circumscribed circle. According to the famous 47th proposition of the first book of Euclid's *Elements:* The square of the hypotenuse of a right-angled triangle equals the sum of the squares on the other two sides; the proof of this proposition is attributed to Pythagoras.

HYPOTH'ECA'TION (ML. *hypothecatio*, from *hypothecare*, to hypothecate, from Lat. *hypotheca*, from Gk. ὑποθήκη, *hypothēkē*, pledge, from ὑποτιθέναι, *hypotithenai*, to place under, from ὑπό, *hypo*, under + τιθέναι, *tithenai*, to place). At Roman law hypothec was the right to take and sell property belonging to another to satisfy a claim. Any balance (*hyperocha superfluum*) remaining after a creditor's claim was satisfied was restored to the former owner of the property. Hypothec might be established by the act of the owner (English mortgage), or it might be created by law (English lien). In either case the hypothecation might be of real property or of personal property, or of both. Many of the legal liens extended over the debtor's entire estate, real and personal. Hypothec was distinguished from pignus or pledge, in that it was established without delivery of possession. In modern civil law the term hypothec is commonly restricted to the mortgage or lien upon real property. At French law a lien upon movables or upon an entire estate is termed a 'privilege.' In Spanish law the term is restricted to the contractual mortgage of real property; all legal liens, whether upon realty or personalty, are 'preferences.' In Scotland, however, a legal lien upon personal property is called a hypothec. Consult the authorities referred to under REAL PROPERTY.

HYPOTH'ESIS (Gk. ὑπόθεσις, supposition, from ὑποτιθέναι, *hypotithenai*, to place under, from ὑπό, *hypo*, under + τιθέναι, *tithenai*, to place). In scientific procedure, a conjecture as to the explanation of any phenomenon, made provisionally and used as a starting-point for further investigation and theory. Thus in studying the motion of the moon Newton made the hypothesis that its divergence from the straight line was due to the same cause that brings an apple to the ground when released from the stem. He then proceeded to find whether the rate of fall in the two cases was expressible by some single formula. After years it was discovered that this was the case. It is now quite generally admitted that an hypothesis, to have any value, should be based on some known law, and should be the conjectural extension of that law to a new sphere under investigation. Thus Newton worked from the known law of gravitation on the surface of the earth. The hypothesis of a luminiferous ether is based on the known laws of the motion of fluids, etc. Such a known law is called a *vera causa*. Some logical purists insist not only that the point of departure must be a known law, but that the extension of this law to another sphere may not be legitimately made unless its extension is at least conceivably verifiable by sense-perception. Thus they claim that the existence of the luminiferous ether is not a rigidly logical hypothesis, because the ether is thought of as having no properties perceivable by our senses without the use of instruments that no one even supposes capable of construction. Such an interpretation of the *vera causa* is, however, not in accordance with actual scientific practice, nor is it theoretically justifiable. It would rule out the hypothesis of the prevalence of gravitation even within the solar system, as no one ever did or presumably ever will perceive with any of his senses the action of gravitation except as a *movement*, and this movement is the thing to be explained by the law of gravitation, and not its further perceptual justification. An hypothesis is a provisional attempt to *think* things together as instances of the prevalence of the same law; and all that is necessary to make an hypothesis valuable is that it should furnish some conception which shall at least provisionally unify experience by reducing it to law. A distinction is often made between theory and hypothesis. A theory is said to be a verified hypothesis. This distinction is one of degree, not of kind. Even an hypothesis which has been 'verified' may be overthrown by new facts; so that it is rather the fashion nowadays to speak of all the conceptions of natural science as '*working* hypotheses,' and to say that they are accepted only tentatively as the basis for further investigations and for further theorizing on results. As to whether there is any unconditional element in scientific conceptions, see KNOWLEDGE, THEORY OF. For bibliography of the subject, see the works cited in the article LOGIC.

HYPOTHETICAL QUESTION. A legal term for the proper form of question to be asked an expert witness. See EVIDENCE.

HYPOXANTHIN, hī'pō-zăn'thĭn (from Gk. ὑπόξανθος, *hypoxanthos*, yellowish-brown, from ὑπό, *hypo*, under + ξανθός *xanthos*, yellow), or SARKIN, $C_5H_4N_4O$. An organic substance chemically allied to xanthin, which it usually accompanies. If given to birds, hypoxanthin is excreted largely in the form of uric acid; it is not known by what organ this transformation is effected—probably not by the liver. See XANTHIN.

HYPSIPYLE, hĭp-sĭp'ĭ-lē (Lat., from Gk. Ὑψιπύλη). The daughter of Thoas of Lemnos, whom she saved when the women of the island killed all the other men in revenge for their neglect. When the Argonauts came to Lemnos, Hypsipyle became by Jason the mother of two sons, Euneus and Nebrophonus or Thoas. Having been driven out because she had spared her father, Hypsipyle became the nurse of Opheltes, son of the Arcadian King Lycurgus. When

Adrastus and the other heroes were on their way to the siege of Thebes, they met Hypsipyle in the Nemean forest and begged her to show them a spring, and during her absence the boy was killed by a serpent. For this neglect she was imprisoned, but was rescued by her sons. The funeral games instituted by the heroes for the dead Opheltes were the origin of the Nemean Games.

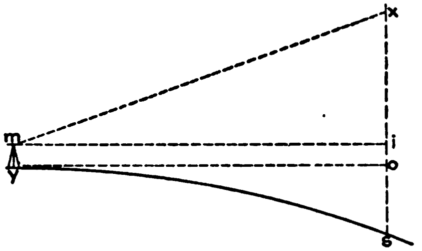
HYP'SISTA'RIANS (from Gk. Ὑψιστάριοι *Hypsistarioi*, Hypsistarians, from ὕψιστος, *hypsistos*, most high, from ὕψι, *hypsi*, on high). A small sect which existed in the fourth century in Asia Minor. It seems to have been monotheistic and Jewish in some of its features, and in others Christian, debased by Sabean elements. Thus it taught the unity of the Deity, and His universal dominion; that sacrifices and other phenomena of external worship were to be given up; at the same time it enjoined Sabbath observance and the dietary laws of the Jews.

HYPSOM'ETER (from Gk. ὕψι, *hypsi*, on high + μέτρον, *metron*, measure), or Thermo-Barometer. An instrument to determine the atmospheric pressure and altitude at a given point by ascertaining accurately with a thermometer the temperature at which water boils. The boiling-point of water diminishes with a decrease in the pressure of the atmosphere, and this always comes with an increase in elevation above the sea-level. With the barometer (q.v.) it is possible to measure heights with considerable exactness; consequently, by knowing the atmospheric pressure corresponding to the temperature at which water boils, we are able to find the altitude. The apparatus to determine the boiling-point was first used by Wollaston in 1816, and consisted of a metal vessel containing a delicate and carefully tested thermometer with graduations extending from 80° to 100° C., which could be read to .01 of a degree. There is a spirit lamp to boil the water, and the instrument is far more portable than a mercurial barometer. The relation between the boiling-point of water, the height of the barometer, and the altitude is shown in the following table, which is calculated for a mean temperature:

Boiling-point (Centigrade).	100°	99°	98°	97°	96°	95°	94°	93°	92°	91°	90°
Height of barometer (mm.).	760	732.2	707.1	681.9	657.4	633.7	610.6	588.3	566.7	545.8	525
Elevation (in meters).........	0	305	610	920	1225	1540	1850	2165	2485	2800	3120

From this table it will be seen that a variation of .1° in the boiling-point at sea-level corresponds to a decrease in the height of the barometer of 2.7 mm., at an elevation of 1000 meters 2.5 mm., at 2000 meters 2.2 mm., and at 3000 meters 2 mm. An approximate rule to determine the elevation of a place by this method, expressed in feet and Fahrenheit degrees, is to multiply the difference between the observed boiling-point and 212° by 550, if the height is less than half a mile, and by 560 if it is in excess of that amount, these factors representing the average amount of altitude corresponding to 1° at 70° Fahrenheit.

HYPSOM'ETRY. The art of measuring heights on the earth's surface. Such measurements are performed by means of trigonometrical observations and calculations; by running a line of precise levels starting from mean sea-level and terminating at the point whose height is to be measured, and by barometric observations and calculations. The second of these methods of measurement gives exact heights, but the other two methods give approximate heights only. To illustrate the application of the three methods of measurement a supposititious case will be assumed and each method applied to its solution. Let *x* represent the top of a mountain whose height above the base *s* it is desired to measure by trigonometrical observation, and whose distance *mi* from the point of observation is known. The instrument is set up at *y* and by it the vertical angle *imx* is measured. This gives the observer a triangle *mix*, of which the side *mi*, the angle *imx*, and the angle *mix* (90°) are known, and from these data he can readily calculate the length of the side *ix*. To this dimension in order to get the height of the mountain he must add the dimension *io*, which is the height of the instrument above the ground, and the dimension *os*, which is due to the curvature of the earth. The dimension *io* is easy to determine, but *os* has to be calculated. Now the curvature of the earth is 0.667 foot, or nearly 8 inches in one mile, and increases as the square of the distances, being thus 32 inches in two miles and 72 inches in three miles. If then the distance *mi* is one mile, the dimension *os* is 0.667 foot. Owing to the refraction of the atmosphere, however, the point *x* always appears to the observer to be higher than it really is, and at an average this deceptive elevation amounts to one-seventh of the curvature of the earth, and, like the latter, varies with the square of the distance. For a distance *mi* equal to one mile, then, the dimension *os* is 0.667 foot, due to curvature minus one-seventh of 0.667 foot due to refraction, which makes it 0.5714 foot. In careful geodetic work the calculations for refractions and curvature are made with much more precision than is done above and the instrument observations are made with exceeding care, but the general method is the same. At best such measurements are only approximate, since the determination of the refractions, which depends upon the atmospheric conditions, can be approximate only. To measure the height *xs* by leveling, the observer starts from mean sea-level and runs a line of precise levels inland, which terminates at the point *x*, and establishes accurately its height above mean sea-level. The same result may be accomplished by starting the line of levels to *x* from a point on a line of levels previously run from mean sea-level. The method of running precise levels differs from ordinary spirit level-



ing (see LEVELING) only in the greater accuracy of the methods and instruments used.

For measuring heights by barometric observations the form of barometer known as the aneroid barometer is usually used. Mercury barometers may of course be used, but usually they are not, owing to the greater difficulty in transporting them and of keeping them in proper working order. The adaptability of the barometer as an instrument for measuring heights depends upon the facts that the mercury column falls as the atmospheric pressure decreases, and that the atmospheric pressure decreases gradually as we ascend above the sea-level. As a rough average it may be assumed that the barometer falls 1-10 inches for about 106 feet rise. To measure the height *sx*, therefore, barometer readings are taken simultaneously at *s* and at *x*, and from them the difference in height of *s* and *x* may be found by the formula,

$$d = 6000\ (\log. \mathrm{H} - \log.\ h)\left(1 + \frac{\mathrm{T} + t - 60}{900}\right)$$

in which *d* equals the difference in height; H and *h* are the two readings, and T and *t* are the temperature of the two stations in degrees Fahrenheit. In the most accurate barometric work various refinements of observation and calculation are introduced, but the general principle of the operation is the same as has been described. Barometrical measurements of heights are only approximate, since the moisture and dryness of the air, the wind, and various other atmospheric phenomena cause variations in the readings recorded, and no formula can possibly be devised that will embrace all these sources of error. Simultaneous observations, with barometers adjusted to the same standard, give the most reliable results. For a full discussion of the methods of measuring heights by trigonometrical leveling, precise leveling, and barometric observations, the reader may consult Johnson, *Theory and Practice of Surveying* (New York, 1900). See SURVEYING.

HYRA′CEUM (Neo-Lat., from Gk. ὕραξ, *hyrax*, mouse; connected with Lat. *sorex*, shrew-mouse). A peculiar substance found in the crevices of the rocks of Table Mountain, Cape of Good Hope. It is one or more of the excrements of the Cape hyrax (*Hyrax capensis*). Hyraceum is a blackish-brown viscid material, not unlike soft pitch, having a strong and offensive taste, not unlike castoreum, for which it has been used as a substitute in medicine, though now obsolete. At one time so large a quantity was found as to suggest the idea of its being used as a manure, but the supply was soon exhausted.

HYRAC′ODON (Neo-Lat., from Gk. ὕραξ, *hyrax*, mouse + ὀδούς, *odous*, tooth). A primitive fossil rhinoceros found in the Miocene rocks of Western America and Europe. See RHINOCEROS.

HY′RACOTHE′RIUM (Neo-Lat., from Gk. ὕραξ, *hyrax*, mouse + θηρίον, *thērion*, diminutive of θήρ, *thēr*, wild beast). An extinct four-toed ungulate mammal of the size of a fox, generally considered as an ancestral horse, remains of which are found in the Lower Eocene deposits of Europe and Western North America. See HORSE, FOSSIL.

HY′RAX (Neo-Lat., from Gk. ὕραξ, mouse). A general name for a suborder (Hyracoidea) of small peculiar ungulate mammals comprised in a single genus and family (Procavia, Procaviidæ), whose species are locally called 'conies,' 'damans,' and 'rock-rabbits.' Some fourteen species are known in Southwestern Asia, and in Eastern and Southern Africa. Although having the size and superficial appearance of rodents, and long so considered, Cuvier pointed out their essential agreement, in dentition and anatomical characters, with the ungulates. The molars are quite similar to those of the rhinoceros, but the upper jaw has two incisors curving downward, and during youth two very small canines, the lower jaw four incisors without canines. The skull, also, and other bones resemble those of the rhinoceros. The muzzle is short and pointed; the ears short and round. The ribs are more numerous than even in the rhinoceros—21 pairs, a number exceeded in no quadrupeds except the sloths, whereas no rodent has more than 15 pairs. The toes are united by the skin, as in the elephant and rhinoceros, and are round and soft, merely protected in front by a broad nail, which does not reach the ground. The legs are short. The tail is a mere tubercle. Their bodies are clothed with thick, uniformly dark-brown hair, except that it is discolored around a curious gland near the middle of the back, which is naked in several species.

The habits of all the conies (except the tree-hyraces) are much alike. The typical Abyssinian species live in rocky or stony places, in communities, like rabbits, and make their homes in holes under rocks or in a rocky watercourse. They seem to be mainly nocturnal and feed at night or in the early morning on leaves and young shoots of trees and bushes. In daytime they lie on rocks in the shade until toward noon, when they are likely to retire to their holes. They are very timid, and disappear when they are in the least danger. The only sound they seem to make is a shrill squeak when suddenly alarmed. This description will remind the reader of the closely similar behavior of the pikas (q.v.) of the Rocky Mountains, often called 'conies.' Mosely speaks of 'a short, hissing noise,' as the alarm cry of the Cape hyrax. All climb about smooth rocks with wonderful agility, which is explained by soft, almost suction-giving pads on the soles of their feet. (Consult Schweinfurth, *Heart of Africa*, vol. i., Leipzig, 1878.) The species longest known is the only Asiatic one (*Procavia Syrica*), which inhabits Arabia, Syria, and Palestine, and is the animal called 'cony' in the ordinary version of the Bible, for which the Syrian name is 'daman.' It was among those animals prohibited to the Israelites under the mistaken belief that they chewed the cud; but they are now eaten by the Arabs, though not regarded as very palatable by Europeans. Several species inhabit Abyssinia and East Africa, down to Mozambique; and Cape Colony and Natal are the home of a kind (*Procavia Capensis*) having very fine, soft, brown fur, with the spot on the back black, which is familiar to the English colonists under the names 'rock-badger' and 'rock-rabbit,' and to the Dutch as 'dasse.' They are often tamed as pets.

Three species of the genus Dendrohyrax, which live in East and West Equatorial Africa, differ decidedly from other conies by the habit of spending their lives and making their breeding nests in holes in trees. These three species agree in that the females have but a single pair of teats (other hyraces have three pairs), and the West Coast one is remarkably large and furry, so that its skin is of much value as material for cloaks.

Consult for systematic revision of the order, Thomas, "On the Species of the Hyracoidea," in *Proceedings of the Zoölogical Society of London* (London, 1892).

HYRCA′NIA (Lat., from Gk. Ὑρκανία, *Hyrkania*). An ancient district of Asia, south of the Caspian Sea (anciently called *Hyrcanum Mare*), bounded on the southeast by the Sariphi Mountains (now Elburz), which separated it from Parthia, and on the west by Media. It corresponded to the modern Mazanderan and Astrabad. The district is called *Vehrkāna* in the *Avesta*, a name which recalls the ancient name for wolf (*vahrka*). The region was wild and heavily wooded, and not generally fertile with the exception of the valleys among the hills, which produced corn, oil, and wine.

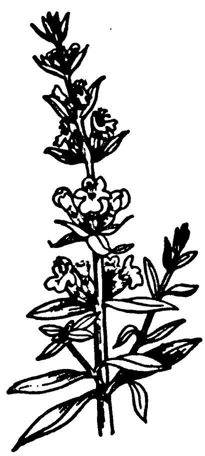
HYRCA′NUS (Lat., from Gk. Ὑρκανός, *Hyrkanos*). The name of two Jewish high priests and princes of the Asmonean family. (1) JOHN (Heb., Johanan) HYRCANUS, son of Simon Maccabæus, was, during the lifetime of his father, governor of the seacoast, with his seat in Gazara, and defeated Cendebæus, the Syrian general. When Ptolemy succeeded in murdering Simon, an attempt was made also on Hyrcanus, but he escaped and obtained control of Judea (B.C. 135). At the beginning of his reign Antiochus Sidetes invaded the country, and Hyrcanus was compelled to sue for peace after having been shut up in Jerusalem. Antiochus showed himself inclined to be sparing and Jerusalem escaped destruction. Shortly afterwards Judea assisted Antiochus in a campaign against his brother, Demetrius Nicator, in which, however, Antiochus lost his life. Demetrius's short reign marked a period of internal dissensions in Syria, which enabled Hyrcanus to establish the independence of Judea. In this his alliance with Rome (a policy inaugurated by his uncle Judas and followed by his father Simon) was of material help. After the fall of Demetrius and his rival Alexander Zabina, Hyrcanus began (B.C. 123) the conquest of troublesome neighbors. First attacking Medaba in the Jordan district, he marched toward Schechem and succeeded in destroying the Samaritan temple on Mount Gerizim (c. 120 B.C.), though the Samaritans were not brought to submission till c. 109 B.C. Next the Idumæans were conquered and compelled to accept the Jewish faith. Even the trans-Jordanic peoples felt the power of Hyrcanus, and under his strong rule Judea reached the highest point of its power and equaled the Judea of Solomon's day. Coins were minted with the inscription, "Johanan High Priest and Chief of the Commonwealth of the Judeans." Like the Maccabees before him, Hyrcanus was a Pharisee, but because of an aspersion cast upon his mother, who had been a prisoner of war, he became a Sadducee, and the latter part of his reign was involved in this factional difficulty. He died in B.C. 105 and left five sons—Aristobulus, Antigonus, Alexander, Absalom, and another whose name is not known—two of whom, Aristobulus I. and Alexander Jannæus, governed with the title of king. (2) HYRCANUS II., son of Alexander, and grandson of the preceding. On the death of his father, B.C. 79 (or 78), he was appointed high priest by his mother, Salome Alexandra, who ruled Judea herself for several years. After her death (B.C. 69), he became temporal ruler also; but his younger brother, Aristobulus, an abler and more energetic man, seized the government, and forced Hyrcanus to make an agreement by which Aristobulus was to rule and Hyrcanus be only high priest. Induced by the Idumæan Antipater, he broke this agreement, and, aided by Aretas, King of Arabia Petræa, he endeavored to win back his dominions. Scaurus, the legate of Pompey, was bribed by Aristobulus, and Aretas had to abandon the siege of Jerusalem. By counter bribery on the part of Antipater, Hyrcanus obtained the control. Pompey took away the kingship from Hyrcanus, leaving him high priest, and proclaimed Antipater governor of the country. Aristobulus and his two sons, who had been carried away captives, tried at different times to wrest the power from Antipater, but failed. Finally, in B.C. 47, Cæsar made Hyrcanus tetrarch and high priest and Antipater was made procurator. Those around Hyrcanus and Hyrcanus himself began to suspect Antipater, and, while banqueting with Hyrcanus, Antipater was poisoned (B.C. 43), though Hyrcanus was not involved in this act. In B.C. 40 Antigonus, son of Aristobulus II., with the help of the Parthians, invaded the land, captured Hyrcanus by treachery, cut off his ears, and thus disqualified him for the office of high priest, and carried him off to Seleucia, on the Tigris. Some years later Herod, son of Antipater, obtained supreme power in Judea, and invited the aged Hyrcanus home to Jerusalem. For some time he lived in ease and comfort, but, falling under suspicion of intriguings against Herod, was put to death (B.C. 30). Consult Grätz, *Geschichte der Juden* (Berlin, 1854-75), vol. ii., chaps. i.-iii.

HYRIEUS, hī-rī′ē-ŭs *or* hĭr′ĭ-ûs (Lat., from Gk. Ὑριεύς, *Hyrieus*, Οὐριεύς, *Ourieus*). Son of Poseidon and King of Hyria in Bœotia, for whom Agamedes and Trophonius built a treasure-house. In this, one stone was so arranged that it could be removed from the outside, thus enabling them to plunder the treasury at will. When Agamedes was finally caught in a trap set by the King, Trophonius cut off his brother's head to prevent discovery, and fled to Lebadea, where he was swallowed up by the earth. (See TROPHONIUS.) The story is that of Rhampsinitus in Herodotus, and is found as a folk-tale in many lands, and in many variations.

HYRTL, hĕr′t'l, JOSEPH (1810-94). An Austrian anatomist, born in Eisenstadt in Hungary. He was educated at the University of Vienna. He became professor of anatomy at Prague in 1837, and filled a similar position at Vienna from 1845 to 1874. His last years were spent in retirement and almost total blindness. Hyrtl endowed several charities in Vienna. His high rank in the scientific world was recognized before his death by the erection of a colossal marble statue in the arcade of the University of Vienna (1889). His researches dealt with comparative anatomy, especially that of fishes, the construction of the ear and of the testicles, and above all, with the subject of angiology, in which his great discoveries were made. Besides monographs on such subjects, including *Untersuchungen über das Gehörorgan des Menschen und der Säugetiere* (1845), *Vergleichende Angiologie* (1850), and *Die Blutgefässe der menschlichen Nachgeburt* (1870), he wrote on general anatomy, *Lehrbuch der Anatomie des Menschen* (1846; 20th ed. 1889), and a valuable and original *Handbuch der* *topographischen Anatomie* (1847; 7th ed. 1882); and on the history of anatomical nomenclature, *Das Arabische und Hebräische in der Anatomie* (1879), *Onomatologia anatomica* (1880), and *Die alten deutschen Kunstworte der Anatomie* (1884). But his most important work was as a technical anatomist. He had great practical skill, devised special preparations for the dissection of various organs and a microscopical preparation to show the capillary vascular network of the lesser organs, and wrote a *Handbuch der praktischen Zergliederungskunst* (1860).

HYSLOP, hĭs′lop, JAMES (1798-1827). A Scottish poet, born and brought up on a farm in Kirkconnel Parish, Dumfriesshire. He was entirely self-taught, but while in the employ of a sheep-farmer in Muirkirk (1812-16), he became imbued with the Covenant associations of Airdsmoss, which inspired his best poem, "The Cameronian's Dream" (*Edinburgh Magazine*, 1821). Besides other poems, he published in the same periodical his accounts of a three years' voyage to South America, whither he was taken as tutor on a war-ship, having had previous experience of teaching in Greenock. After spending three years ashore, in teaching and journalism, Hyslop embarked again as tutor on H.M.S. *Tweed*, but within a month died of fever near the Cape Verde Islands, and was buried in the Atlantic. His poems, eighty-two in all, were published in Glasgow (1887), and two years afterwards his masterpiece was set to music by Hamish McCunn (q.v.).

HYSSOP (AS. *ysope*, from Lat. *hysopum*, *hyssopum*, *hyssopus*, from Gk. *ὕσσωπος*, *hyssōpos*, *ὕσσωπον*, *hyssōpon*, hyssop, from Heb. *ēzōb*, sort of aromatic plant), *Hyssopus*. A genus of one species of the natural order Labiatæ. The common hyssop (*Hyssopus officinalis*), a native of Southern Europe and the East, and naturalized in the United States, is a half-shrubby evergreen plant, about 1½ feet high, with beautiful blue flowers arranged in one-sided whorled racemes. It has long been cultivated for its aromatic leaves, young shoots, and seeds, which are sometimes used to season salads and soups, but more generally in a dried state as a stomachic and carminative. The virtues of hyssop depend on a volatile oil. A syrup made from the leaves is sometimes used for colds, but the plant is less in favor than formerly. It has been supposed that the hyssop of the Bible is some species of Phytolacca, as *Phytolacca acinosa*, a native of the Himalayas; but the common caper has also been so considered. Hedge-hyssop is *Gratiola officinalis.*



HYSSOP.

HYSTASPES, hĭs-tăs′pēz (Lat., from Gk. Ὑστάσπης). A name found several times in Persian history. (1) It was the name of the father of King Darius I., and according to the Old Persian inscriptions he was Governor of Parthia, and his father's name is given as Arshāma, which agrees also with Herodotus. The name Hystaspes, or Vishtaspa, of the inscriptions, is identical in form with Vishtaspa, the name of Zoroaster's patron, in the *Avesta;* but there is no historical ground for identifying the two personages, as has been erroneously done by some. The allusion to Hystaspes in Lactantius in the Church Fathers seems to have reference to Zoroaster's patron. Consult Jackson, *Zoroaster, the Prophet of Ancient Iran* (New York, 1898). (2) HYSTASPES, the son of Darius I. and Atossa, was a brother of Xerxes, and commanded a force of Bactrians and Sacæ in the latter's army.

HYSTASPES. An ancient author, according to the testimony of several of the Church Fathers. He is supposed to have been a *magus* who wrote a book called *Vaticinia.* Of his life or date we are entirely ignorant. Two passages regarding his writings occur in Justin Martyr, one saying that he foretold the destruction of the world by fire, as the Sibyl did, and the other mentioning the book in connection with the Sibylline works and the prophetic books of the Old Testament as loathed by the evil demons. There is in the writing of Clement of Alexandria a reference of doubtful meaning, but usually construed to say that the work was in existence in the second century, and that it referred to the coming of the Messiah and to His kingdom; and another in Lactantius, where Hystaspes, like the Sibyl, is said to predict the destruction of Rome, and is quoted as describing the wickedness of the last time, its misery, and the final destruction of the unjust. The name points to Persian origin; but the possibility that it was merely the name of the work, as seems evident from the passage in Clement, when the choice would be due to the fame of the Magians, makes the origin of the work uncertain. Even its existence cannot be considered proved, much less that of an author called Hystaspes. Consult Kuhn, "Eine zoroastrische Prophezeiung in christlichem Gewande," in *Festgruss an Roth* (Stuttgart, 1893).

HYS′TERE′SIS (Neo-Lat., from Gk. *ὑστέρησις*, deficiency, from *ὑστερεῖν*, *hysterein*, to be behind, from *ὕστερος*, *hysteros*, latter; connected with Skt. *ud*, AS. *ūt*, OHG. *ūz*, Ger. *aus*, Eng. *out*). The name given a phenomenon in the magnetization of magnetic substances, which was first observed by Warburg, in 1881, and later, in 1885, independently by Ewing, to whom the name is due. It is found that if a rod of iron—or any magnetic substance—is placed in a magnetizing helix, and the electric current through this gradually increased to a certain value, and then slowly decreased, the magnetic properties of the rod do not follow the same course when the magnetizing current is decreasing as they did when it was increasing. All the properties due to the magnetization—the induction, the change in length, the change in elasticity, etc.—lag behind the magnetizing force. That is, if these properties have certain values for a given magnetizing force when the current is increasing, they will not return to the same values, when, as the current is decreasing, the same magnetizing force is reached; but this force must be still further decreased, or even reversed, before these same values are again obtained. The amount of hysteresis varies greatly with different qualities of iron and steel, and with different substances. Its value is most important from a commercial standpoint, because each time the magnetization of a piece of iron is reversed—as happens at each alternation of an alternating electric current—there is a definite amount of energy lost in heating the iron, and this amount depends on the hysteresis. There is another kind of hysteresis which is quite different. If a given magnetizing current is applied suddenly to a rod of iron, it may not attain its full magnetism instantly; and the fact that time is required to reach this is said to be due to 'viscous' hysteresis or 'magnetic lag.' For a full discussion of the importance of hysteresis, and of the molecular theory, which explains it, consult Ewing, *Magnetic Induction* (London, 1891). See MAGNETISM.

HYSTE'RIA (Lat., from Gk. ὑστέρα, *hystera*, womb; connected with Lat. *uterus*, womb, Skt. *udara*, belly). A diseased state of the nervous system characterized by a great variety of symptoms denoting disordered nervous functions. It was formerly considered to be a disease of the womb, and hence came its name; and it was at one time thought to be trifling and under the control of the will of the patient. Both these ideas are erroneous; for hysteria is frequently found among males, and is a disease of very serious nature, involving not only the brain and spinal cord, but also the peripheral nerves and the sympathetic system. While comparatively rare among Anglo-Saxons, it is said to be widespread among Latin nations and Scandinavians, being especially frequent among the French. Hysteria arises from predisposing causes of an hereditary nature, such as parental alcoholism, epilepsy, insanity, or hysteria, as well as injudicious training or education in youth, with depressing influences, as of surroundings. Exciting causes are overwork, worry, excessive responsibility, sexual excesses, profound or prolonged grief, and emotional or other mental shock, and lastly severe trauma, such as a railway accident, fall, or blow may produce. Hysteria is found among the working classes as well as among the idle, wealthy, and self-indulgent, who have never learned self-control or practiced self-denial. Two forms of hysteria are described, for reasons of convenience rather than for scientific reasons, as follows: (1) The form of the disease in which the patient is excitable, emotional, and perverse without cause and without intention, and has disturbances of sensation, motion, circulation, secretion, and excretion; usually falling into this condition after strain or stress, a disappointment, or great fatigue. (2) The form of the disease in which the patient has convulsive attacks, known by some as *hysteria major*, in contradistinction to the former variety, which is sometimes called *hysteria minor*. The patient may suddenly sink to the floor, become partly unconscious and rigid, and, either turning pale or remaining rosy, may breathe violently for a few minutes, and then recover perfect consciousness. Or the patient may sink to the floor after experiencing a sharp pain or an aura of some sort, uttering a little cry or calling for help, with pale or ashen face, and dilated pupils. Convulsions follow rigidity, resembling epileptic convulsions; there may be frothing at the mouth; after a short relaxation, during which the patient gasps, a repetition of the convulsions occurs, with absolute unconsciousness. Then the patient rolls, tossing the arms and legs about, and assuming various rigid positions, occasionally bending the head forward, doubling up the body, clenching the fists, and folding the arms across the chest or the abdomen, or bending the head and feet backward in the pose called opisthotonos. After several repetitions of such actions, the patient remaining unconscious, relaxation occurs with a short period of repose, followed at once by attitudes of petition, depression, gayety, etc., the patient being delirious and talking of past events or imaginary encounters, not recognizing, though speaking with, those around her, and controlled by hallucinations of sight and hearing. In a varying time the delirium ceases and the patient becomes conscious, exhausted, and complaining of tenderness in some part of the body, passes a large quantity of pale, limpid urine, and generally resumes her occupation or goes about her house as if nothing had happened. The whole attack may last from 15 to 50 minutes. If these attacks are frequently repeated, the patient's strength is rapidly undermined, and she may be confined to her bed. The form of hysteria with convulsive seizures is often called *hystero-epilepsy* (q.v.)—an unfortunate and misleading term, which should not be used. It really means a combination of hysteria and epilepsy in the same person, which is possible, but rare.

Hyperalgesia confined to certain spots, circumscribed areas of anæsthesia, or anæsthesia of a half of the body, hysterical deafness, hysterical blindness, twitching of muscles, or contractures of groups of muscles, the '*globus hystericus*,' or feeling of a lump in the throat, spasmodic closure of the glottis with pseudo-asthma, retention of urine, paralysis (either hemiplegia or paraplegia), palpitations of the heart, flushing of face, neck, and scalp, with sweating, coldness of extremities or of the entire body, œdema of the extremities, menstrual irregularities, and vomiting of fluid, are among the symptoms of the disease. Mental changes are certain to occur, amounting only to lack of balance and of will power, or impairment of memory in some, in others also recurring melancholy, rapid emotional play, lack of power of application, impaired judgment, diminished regard for truth, and craving for sympathy. The last two symptoms are the basis for the peculiar actions of 'fasting girls;' self-mutilating martyrs; alleged sufferers who feign paralysis, pain, tumor, stone in the bladder, etc., and who eagerly submit to surgical operations.

Hysteria is not dangerous to life. Recovery is rare in prolonged cases, though proper treatment may be followed by cure in cases in which symptoms have reappeared upon provocation many times in the course of a year or two. Harshness used on the erroneous supposition that willfulness or perversity is at the foundation of hysteria always does harm, and is unjustifiably brutal. Relief of strain and of worry, change of environment, removal of the patient from home and from accustomed companions in the family, and treatment for indigestion, restoration of function, and nerve-building, form the principal features of remedial agencies. Will power must be systematically cultivated, and moral support be given to the patient. Massage, electricity, diet, baths, and sometimes a rest cure, are efficacious. See INSANITY; HYPNOTISM; TEMPERAMENT. Consult: Janet, *Etat mental* *des hystériques: les accidents mentaux* (Paris, 1894); Richer, *Paralysies et contractures hystériques* (Paris, 1892).

HYSTER'ICS. See HYSTERIA.

HYS'TERO-EP'ILEP'SY. An improper, though frequently employed, term for a variety of hysteria, in which convulsive attacks occur, of an epileptoid nature. It is not a form of epilepsy, though not differentiated from that disease till Charcot, of Paris, gave an accurate and intelligent description of hysteria. See HYSTERIA. Consult: Feré, "Notes pour servir à l'histoire de l'hystéro-épilepsie," in *Archives de Neurologie* (Paris, 1882).

HYS'TEROT'OMY. See CÆSAREAN OPERATION.

HYTHE, hīth (AS., haven). A market-town and parliamentary borough in Kent, England, 14 miles south of Canterbury. Hythe is a favorite seaside summer resort, and the seat of the national school of musketry (Map: England, H 5). It has an interesting church, partly Norman and partly Early English. Under the chancel is an extraordinary collection of human skulls and bones—many of the skulls having deep cuts in them; their age and origin are uncertain, but they are reputed to be the remains of Danes slain in a battle fought about 1000. Hythe owns its waterworks. It is one of the Cinque Ports, but through the silting of its harbor has become removed half a mile from the coast. Population, in 1891, 4347; in 1901, 5557; population of parliamentary borough in 1891, 35,547; in 1901, 46,663.

I

I The ninth letter in the alphabets of Western Europe. Its form in the Phœnician and early Greek alphabets, from which it is derived, somewhat resembled a narrow upright Z. (See ALPHABET.) After various modifications this was straightened into its present shape. The Greek designation, *iota*, of the letter is an adaptation of its Phœnician name *yod*, 'a hand.' The dot over our small *i* did not come into use until the fourteenth century.

PHONETIC CHARACTER. The 'short i' in English is described as a high-front or palatal vowel, made by the blade of the tongue approximating the forward part of the palate or roof of the mouth—the sound heard in *it*. When approximated so far as to make a partial contact or closure, this passes over into a semi-vocalic or consonantal *y*, as in *you* (*iu*), although in English the *y* is often not written, e.g. *minion, million;* other variations may be noticed in *charity, bird*. The corresponding 'long i,' common in European languages, is found in *machine, police, pique*. This is sometimes known as the 'long e' sound in *receive, believe, seat*. The sound commonly called 'long i' in English, *wide, ice*, and the name of the letter itself (*i* pronounced *eye*), is really a diphthong, like *aisle*, made by premature opening of the lengthened vowel under stress-accent. This phonetic change from the older character of the sound was going on during the Middle Period of transition into the Modern English, so that it is now a phonetic rule that Anglo-Saxon or Old English *ī* regularly calls for a diphthongal long i in modern English, e.g. OE. *wīd, mīl* = Mod. Eng. *wide, mile*. Historically the linguistic character of *i* is fairly stable, Indo-Germ. **uidhevā*, Skt. *vidhávā*, 'widow,' Lat. *vidua*, OChurch Slav. *vidova*, AS. *widewe*, Eng. *widow;* or Gk. οἶνος (for ϝοῖνος), 'wine,' Lat. *vinum*, A.S. *wīn*, Eng. *wine*. For the connection of I and J, see J.

As a Symbol.—I in the Roman notation stands for 1; in chemistry I = iodine; in logic I is the symbol of the partial affirmative proposition.

I′ABA′DU IN′SULA (Lat., translation of Gk. 'Ιαβαδίου νήσος, *Iabadiou nēsos*). According to Ptolemy (vii. 2), a large island in the Indian Ocean, southeast of the Golden Chersonese and southwest of the Isles of Satyrs; said to be very fertile and to contain much gold. The island meant was probably the modern Java, though Humboldt and others regard it as Sumatra. The name, according to Ptolemy, signified *Island of Barley*. The capital was named Argyre ('Αργυρῆ).

IACCHUS, ī-ăk′kŭs (Lat., from Gk. Ἴακχος, *Iakchos*). A title used of Bacchus in the Eleusinian Mysteries, in which he was regarded as the son or husband of Demeter, or the son of Persephone. He was thus distinguished from Dionysus, the son of Zeus and Semele, but was sometimes called his son, and at times identified with him.

IACHIMO, ī-ăk′ĭ-mō. In Shakespeare's *Cymbeline*, a Roman libertine who on a wager conceals himself in Imogen's room and carries away apparent evidence of her unchastity.

IAGO, ē-ä′gō. A Spanish and Portuguese form of the name James, now occurring only in the combination Santiago (Saint James).

IAGO. In Shakespeare's *Othello*, a calculating and malignant character, the ancient of Othello, whom he secretly hates while retaining his confidence. In revenge for imagined wrongs he skillfully concocts evidence which convinces Othello of the unfaithfulness of his wife, Desdemona. Othello in jealousy murders Desdemona, and stabs Iago when the plot comes to light.

IAL′YSUS (Lat., from Gk. Ἰάλυσος). An ancient city on the island of Rhodes, possibly a Phœnician settlement, certainly an important place in the Mycenæan period. It was later colonized by Dorians from Argos, and formed with Lindus and Camirus the Rhodian tripolis. Even in the Homeric poems it is famed for its wealth. In B.C. 408 it united in the foundation of the city of Rhodes (q.v.). Some remains are still traceable near the modern village Ialiso. A necropolis at Ialysus has yielded many Mycenæan vases and other ornaments.

IAM′BIC VERSE (Lat. *iambicus*, Gk. ἰαμβικός, *iambikos*, from ἴαμβος, *iambos*, iambus, from ἰάπτειν, *iaptein*, to assail with words). A term applied in classic prosody to verses consisting of the foot or metre called *iambus*, made up of two syllables, of which the first is short, and the second long (⏑—). Archilochus (q.v.) is the reputed inventor of iambic verse. The term is also applied by analogy to English verse wherein stressed and unstressed syllables correspond to a long syllable followed by a short syllable in Latin or Greek verse. The English language runs more easily and naturally in this metre than in any other.

The stág | at éve | had drúnk | his fill.

See METRE; VERSIFICATION.

IAMBLICHUS, ī-ăm'blĭ-kŭs (Lat., from Gk. Ἰάμβλιχος). (1) A Greek writer of the second century A.D., a Syrian by birth, and the author of the earliest Greek romance of which considerable remains have survived. It was entitled *Babyloniaca*, and described in thirty-five books the remarkable adventures of two lovers, Rhodanes and Sinonis. The original romance has perished, but large extracts are preserved by Photius (chap. xciv.). (See Photius.) There is no great merit in the style, and the plot is full of magic.

(2) A Neo-Platonic philosopher, born at Chalcis, in Cœle-Syria, about A.D. 283. He lived mostly at Alexandria. He studied under the Neo-Platonists Anatolius and Porphyrius, and became deeply imbued with the teachings of Plotinus, which he expounded for many years to a large circle of hearers at Alexandria—but with a considerable admixture of his own peculiar views. He died at Alexandria, about A.D. 330. His doctrines were a mixture of Pythagorean and Platonic ideas, with much superstition and magic, and the supposed manifestation of God by ecstasies, and a communication with the spiritual world by means of ceremonies. He was a voluminous writer, but most of his writings are lost. Perhaps they were destroyed by the Emperor Constantine, who ordered the burning of the works of Porphyrius. Of his work, Περὶ Πυθαγόρου 'Αιρέσεως, in ten books, we possess four complete sections, viz.: *On the Life of Pythagoras* (Περὶ τοῦ Πυθαγορικοῦ βίου) edited by Nauck (Saint Petersburg, 1884); *Exhortation to Philosophy* (Προτρεπτικοὶ Λόγοι εἰς Φιλοσοφίαν), ed. by Pistelli (Leipzig, 1888); *On Mathematics* (Περὶ Μαθηματικῆς 'Επιστήμης), ed. by Festa (Leipzig, 1891); and an introduction to the *Arithmetic* of Nicomachus, ed. by Pistelli (Leipzig, 1894). There is also in existence a work on *Mysteries* (Περὶ Μυστηρίων Λόγος), which is attributed to Iamblichus; but the attribution has been questioned, perhaps, without reason. On Iamblichus and his philosophy, consult: Chaignet, *Histoire de la psychologie des Grecs*, vol. v. (Paris, 1893); and Zeller, *History of Greek Philosophy* (New York, 1889).

IANTHE, ī-ăn'thē. (1) In Roman mythology, a girl to whom Iphis was betrothed (Ovid, *Met.*, ix. 12). (2) A character in Sir William Davenant's *The Siege of Rhodes*. (3) Lady Charlotte Harley, to whom, under the name of Ianthe, Byron dedicated his *Childe Harold*. (4) A character in Shelley's *Queen Mab*.

IAP'ETUS (Lat., from Gk. 'Ιαπετός). One of the Titans, son of Uranus and Gæa, father in Hesiod of Atlas, Menœtius, Prometheus, and Epimetheus. Through Prometheus he is ancestor of Deucalion (q.v.), and so of the human race. Many scholars suppose his name to be identical with the biblical Japhet; others, like Maximilian Meyer, *Giganten und Titanen* (Berlin, 1887), deny any such connection.

IAPYGIA, ī'ȧ-pĭj'ĭ-ȧ (Lat., from Gk. 'Ιαπυγία). A name given to the southeastern district of Italy, forming the heel of the Peninsula; also called Messapia. The name Iapygia was familiar to the Greeks, but was not known to the Romans.

IBA, ē'BÄ. The capital of the Province of Zambales, in Luzon, Philippines (Map: Luzon, A 5). It is situated 122 miles northwest of Manila, and has a post-office and telegraph station and a population (1898) of 3500.

IBADAN, ē-bä'dȧn. The chief commercial city of Yoruba, in the interior of the English colony of Lagos, in Nigeria, Africa. It is a walled town, situated on a small river, the Odo-Ona, 30 miles south of Ojo, and about 85 miles northeast of Lagos, with which latter town it is connected by rail. Its population is estimated at 200,000, including the people outside the walls.

IBAGUE, ē'BÄ-gā'. Capital of the Department of Tolima, Colombia, situated 60 miles west of Bogotá, on a fertile plain, at an altitude of over 4000 feet (Map: Colombia, B 3). It has a temperate and healthful climate, and is a prosperous and important town, with a number of sulphur and silver mines in its vicinity. Its population is estimated at 12,000. Ibague was founded in 1550, and was in 1854 the temporary capital of the Republic.

IBAJAY, ē'BÄ-HĪ'. A town of Panay, in the Province of Capiz, Philippines, situated about 62 miles northwest of Capiz and near the Point of Potol, where the town formerly stood, and where much amber is collected (Map: Philippine Islands, G 8). Population, in 1898, 11,350.

IBALONE, ē'BÄ-lō'nȧ. The ancient name of the Vicol tribe in the Philippine Islands (q.v.), especially on Albay Island.

IBANAG, ē'BÄ-näg'. The speech of the Cagayane people in Luzon. See Philippine Islands.

IBÁÑEZ DE IBÁÑEZ DE IBERO, ē-BÄ'nyȧth dȧ ē-BÄ'nyȧth dȧ ē-BÄ'rō, Carlos, Marquis of Mulhacén (1825-91). A Spanish military engineer and geodetist, born in Barcelona. As a result of his work in geodesy and geography, he was given the title of Marquis of Mulhacén, and was elected to many scientific societies. His publications include: *Base central de la triangulación geodésica de España* (1865); *Descripción geodésica de las islas Baleares* (3 vols., 1871); and *Tableau géographique et statistique de l'Espagne* (1888).

IBARRA, ē-BÄr'rȧ. The capital of the Department of Imbabura, Ecuador, situated at an altitude of over 7000 feet, 60 miles northeast of Quito (Map: Ecuador, B 3). It has some cotton and woolen mills, and a population of about 10,000. Once a considerable town with a population of about 16,000, Ibarra was almost wholly destroyed by the earthquake of 1868.

IBARRA, Joaquin (1725-85). A Spanish printer, born at Saragossa. He was appointed Court printer at Madrid. The following works from his press are among the masterpieces of the art of printing: A translation of Sallust by the Infante Don Gabriel (1772); an edition of Cervantes's *Don Quixote* (4 vols. quarto, 1780; 4 vols. octavo, 1782); the *Historia di Hispana* of Mariana (2 vols., 1780); and several fine editions of the Bible.

IBERCOURT, ē'bâr'kōōr', Henry Louis d' (1771-1818). A Flemish traveler, born in Mons. His journeyings began in the West India Islands, and extended over a great part of South America. His narrations include: *L'Amérique dévoilée* (1811); *Voyage en Chili* (1812); and *Nouveau traité sur les légumineuses de l'Amérique du Sud* (1815). He also wrote a romance, *Un voyageur captif en Patagonie* (1814), and a pamphlet, *La constitution des Etats-Unis, est-elle applicable à l'Europe?* (1818), which so deeply offended the

Dutch Government that the author suffered a short term of imprisonment.

IBE'RIAN MADONNA. A wonder-working picture in the Kremlin, Moscow.

IBE'RIANS (Lat. *Iberes*, Gk. Ἴβηρες). A people anciently living at the mouth of the Iberus or Ebro River, in Eastern Spain. Later, the inhabitants of the entire Peninsula were so called. The term is now applied to the primitive Neolithic and Bronze-age men whose remains and relics are found in ancient graves, grottoes, and refuse heaps throughout Western Europe. Their ovoid and ellipsoid crania, called Pelasgic type by Sergi, resemble those of ancient Italy, Greece, Asia Minor, Egypt, Ethiopia, and North Africa, belonging to what he denominates the Mediterranean race. Keane also quotes Von der Gabelentz in the proof of identity between the Basque or Iberian and the Berber speech. This long-headed man, of low stature, has been traced as far as the British Isles, and is identified with the Picts and other groups. The term 'Iberian' is used by English ethnologists for the Mediterranean race, and Deniker's title for the same group is 'Ibero-Insular.' Keane subdivides the historical Iberian (Basque) as follows. The descendants from old extinct Iberian are:

Euscara (Spanish Basque)...	Guipuzcoan Biscayan, or Upper Navarrese North Upper Navarrese South
Bascunse (French Basque)..	Labordin Souletin, or Lower Navarrese East Lower Navarrese West

Consult: Keane, ***Man: Past and Present*** (Cambridge, 1899); Sergi, ***Mediterranean Race*** (London, 1901).

IBE'RIS. See CANDYTUFT.

IBE'RUS. The ancient name of the Ebro (q.v.).

IBERVILLE, ē'bâr'vēl', PIERRE LE MOYNE, Sieur D' (1661-1706). A French-Canadian soldier, naval commander, and explorer, founder of Louisiana. He was one of the ten famous sons of Charles le Moyne of Montreal. He studied seamanship in the French Navy, but his first exploits were inland—from the Ottawa north to James's Bay, with an expedition destined to gain possession of the English forts there (1686). He took part in the expedition for the destruction of Schenectady (1690). After capturing (1696) and demolishing the stone fort at Pemaquid, built to protect New England, Iberville thought of taking Boston, but sailed instead to Newfoundland, where he burned the village of Saint John's, laying waste all the British settlements on the island. Thence he steered for Hudson Bay, where he had a gallant victory over three English ships against his one, and destroyed the last remaining post of the Hudson's Bay Company. From the far North he went to the far South, sailing from France (1699) to the Gulf of Mexico in search of the mouth of the Mississippi, found it, and built a fort at Biloxi (q.v.), changing afterwards to Mobile, thus fulfilling La Salle's dream of planting a French colony on the Gulf. He left Canada in 1702, and died in France.

IBEX (Lat., chamois). The ancient name of the 'steinbock' of the Alps; and now designating a section or subgenus of goats having the horns flat, and marked with prominent transverse knots in front, whereas those of the typical goats are compressed and keeled in front, and rounded behind. The group contains four species, all inhabitants of high mountainous regions, as described below. All are characterized by a nearly uniform coloration; but the hue varies with age and season, from gray, yellowish, or grizzled, to various degrees of brown, usually lighter on the throat, belly, and inside of the legs than elsewhere. The short summer coat is exchanged in winter for a longer, warmer one, mixed with an under wool. The pairing season of all is in midwinter, and the kids, usually two, are born in early summer. Compare GOAT; and see Plate of WILD GOATS.

The typical ibex (*Capra ibex*), called 'bouquetin' by the French, and 'steinbock' by the Germans, has long been exterminated as a wild animal, but is preserved by the Italian Government in a few valleys of the Piedmontese region. Formerly it seems to have roamed all over the Alps of Switzerland, Savoy, and the Tyrol, but always kept as high as possible, seeking its food, mainly by browsing bushes, at the edge of the snow, and not descending the valleys as does the chamois. Though larger and more powerful than the common goat, it is smaller than the other ibexes. The horns rarely exceed 30 inches in length and have the knobs not prominent, while the beard of the males is so small as to be hardly visible in the summer coat. This ibex is easily tamed when taken young, and interbreeds readily with domestic goats.

The Himalayan ibex (*Capra Sibirica*) is still numerous, and well known to sportsmen. A ram stands 40 inches high at the withers, has a heavy beard, and the roughly knobbed horns often measure more than 50 inches along the outside curve, and 11 to 12 inches in greatest girth. It inhabits all the mountain ranges of Central Asia from the borders of Persia eastward to the frontier of Tibet, and northward into Siberia; and is found not only on the summits, but on the open plateaus of the Pamir. Ordinarily, however, ibexes remain upon the crags as near as possible to the snow-line. They descend in winter only so far as is necessary to find uncovered pasturage, and often linger at that season at great altitudes where the wind sweeps steep slopes, and allows them to nibble a scanty subsistence from the withered herbage. The resistance to cold and hardiness of constitution generally which this implies are characteristic of the race. They usually go about in small bands, led by old rams, but sometimes gather into herds of 100 or more. In the spring the males separate from the band and betake themselves to the highest crags, while the females seek retired places in which to bring forth their young. In spite of constant pursuit by hunters, the ravages of wild dogs, and destruction by avalanches, these animals seem to maintain their numbers (except near Kashmir), as they are prolific, and accustomed to wandering widely. Ibex-shooting is one of the most exciting and difficult feats offered to the sportsman, because of the nature of the country in which the animals live, and their extreme wariness and ability to escape down precipices and over crags which baffle their pursuers. The books of men like MacIntyre, Kinloch, Markham, Pollok, and other Anglo-Indian sportsmen are full of entertaining accounts of this adventurous hunting, and to these observers we owe most of our knowledge of the haunts and habits of these animals.

The Arabian ibex (*Capra Sinaitica*), or 'beden,' occupies the rough heights of the Sinaitic Peninsula, Arabia Petræa, Palestine as far as Lebanon, and Upper Egypt. It is rather smaller than the Himalayan, and the knobs on the front of the horns are less prominent and regular. An Abyssinian species, the 'walie' (*Capra walie*), also exists, and differs from the others in the curvature of its horns and a protuberance in the centre of the forehead.

IBILAO, ē'bē-lä'ō. A head-hunting Malay-Negrito tribe in central Luzon. See PHILIPPINE ISLANDS.

IBIS (Lat. *ibis*, Gk. ἶβις, of Egyptian origin). A stork-like bird of the family Ibidæ. The bill is long, slender, curved, thick at the base, the point rather obtuse, the upper mandible deeply grooved throughout its length. The face, and generally the greater part of the head, and sometimes even the neck, are destitute of feathers, at least in adult birds. The neck is long. The legs are rather long, naked above the tarsal joint, with three partially united toes in front, and one behind; the wings are moderately long; the tail is very short. The family is usually ranked with the storks in the same order as the herons, but there are important points in which the ibises approach the curlews. The sacred ibis, or Egyptian ibis (*Ibis Æthiopica*), is an African bird; 2½ feet in length, although the body is little larger than that of a common fowl. The glossy ibis (*Plegadis falcinellus*) is a smaller species, also African, but migrating northward into Continental Europe, and occasionally seen in Great Britain. It occurs in the tropical and subtropical parts of all the world, but is quite uncommon in North America. In the Southwestern United States it is replaced by the white-faced glossy ibis (*Plegadis guarauna*), a species in which the adults have the region about the base of the bill white. The habits of both species resemble those of the sacred ibis. The color is black, varied with reddish brown, and exhibiting fine purple and green reflections. There are no loose pendent feathers. The white ibis (*Guara alba*) a species with pure white plumage, abounds on the coasts of Florida, and is locally abundant as far north as South Carolina and southern Illinois. Audubon saw multitudes on a low islet, and counted 47 nests on a single tree. (For its egg, see Colored Plate under EGG.) The scarlet ibis (*Ibis ruber*) is a tropical American species, remarkable for its brilliant plumage, which is scarlet, with the tips of a few outer primaries glossy black. The straw-necked ibis (*Carphibis spinicollis*) is a large Australian bird of fine plumage, remarkable for stiff, naked, yellow feather-shafts on the neck and throat, which look extraordinarily like bits of straw. The bird known in the Southern United States as 'wood-ibis' is not an ibis at all, but a stork (q.v.).

The sacred ibis, one of the birds worshiped by the ancient Egyptians, and called by them *hab* or *hib*, and by the modern Egyptians *abu-Hannes* (i.e. Father John), is a bird with long beak and legs, and is covered with black and white plumage. It was supposed, from the color of its feathers, to symbolize the light and shade of the moon, its body to represent the heart; its legs described a triangle, and with its beak it performed a medical operation; from all which esoterical ideas it was the avatar of the god Thoth or Hermes (see MERCURY), who escaped in that shape the pursuit of Typhon, as the hawk was that of Ra, or Horus, the sun. Its feathers were supposed to scare, and even kill, the crocodile. It appeared in Egypt at the rise, and disappeared at the inundation of the Nile, and was thought at that time to deliver Egypt from the winged and other serpents which came from Arabia in certain narrow passes. As it did not make its nest in Egypt, it was thought to be self-engendering, and to lay eggs for a lunar month. According to some, the basilisk was engendered by it. It was celebrated for its purity, and only drank from the purest water, and the most strict of the priesthood only drank of the pools where it had been seen; besides which, it was fabled to entertain the most invincible love of Egypt, and to die of self-starvation if transported elsewhere. Its flesh was thought to be incorruptible after death, and to kill it was punishable with death. Ibises were kept in the temples, and unmolested in the neighborhood of cities. After death they were mummied, and there is no animal of which so many remains have been found at Thebes, Memphis, Hermopolis Magna, or Eshmun, and at Ibiu or Ibeum, 14 miles north of the latter place. They are made up into a conical shape, the wings flat, the legs bent back to the breast, the head placed on the left side, and the beak under the tail. They were prepared as other mummies, and wrapped up in linen bandages, which are sometimes plaited in patterns externally. At Thebes they are found in linen bandages only; at Hermopolis, well preserved in wooden or stone boxes of oblong form, sometimes in form of the bird itself, or the god Thoth; at Memphis, in conical sugar-loaf-shaped red earthenware jars, the tail downward, the cover of convex form, cemented by lime. There appear to be two sorts of embalmed 'ibises'—a smaller one of the size of a rail, very black, and the other black and white. The former is not an ibis at all, but some smaller wading bird. The last is usually found with its eggs, and with its food in its stomach. By the Jews it was held to be an unclean bird. Consult: Wilkinson, *Manners and Customs of the Ancient Egyptians* (New York, 1879); Pettigrew, *History of Egyptian Mummies* (London, 1840).

IB'LIS. One of the names of the Devil, in the Koran, who, however, is more often called *Shaitān* (Satan). Iblis is the chief of the fallen angels, who was once a good angel named Azazil, but having refused at God's command to render homage to Adam, was first condemned to death, but subsequently respited till the judgment day (Koran, vii. 13). The legend is borrowed from Jewish sources, and is embodied in the Midrashic exposition of Genesis, chapter iii. (consult Wünsche, *Midrash Bereshit Rabba*, p. 32 sqq., Leipzig, 1881). Both words for devil used by Mohammed appear to be of foreign origin, the form *Shaitān* coming close to the designation of Satan in Ethiopic—while *Iblis* may be a distortion of *diabolus*, modified in order to adapt it to a derivation from an Arabic stem *balasa* 'to confuse,' with which, however, it has really nothing to do. Of the two terms, the former is found in the Koran 87 times, the latter only 11 times. Moreover, the plural of the former is used, whereas the latter occurs only in the singular, and was regarded by Mohammed as a name for a specific devil, the arch devil spirit; *Shaitân*, both in the Koran and the later literature, is used as a general designation for devils or evilly disposed demons. On the basis of the utterances in the Koran, the doctrine of the Devil is further developed in Mohammedan theology, influenced by the specifically Christian and Jewish conceptions current in the Orient whereby the Devil, as a single personage, usurps the powers and attributes of the numerous body of jinns (q.v.) of popular belief. The latter, however, as a survival of primitive religion, continue to hold sway among the people in general, so that in the folklore of the Arabs it is the jinns who are constantly introduced, both for good and evil purposes, whereas the mention of Iblis and of the Satans is largely confined to the body of theological writings. In the latter the contrast between the Devil and the angels is prominently put forward, and the view is expressed that each individual has a devil and an angel appointed as his companions, the former tempting him to evil deeds, the latter prompting him to good. The life of man passes in a constant struggle to be rid of the former and to keep close to the latter. Consult Weil, *Biblische Legenden der Muselmänner* (Frankfort, 1845).

IBN ABI USEIBIA, ĭb'n ä'bē o͞o-sä'bē-ȧ, Muwaffak ad-Din (c.1195-1269). An Arabic physician and author. He was born in Cairo, of a family of physicians; lived in Egypt and Syria, and was educated at Damascus (1227-33). For two years he was head of a hospital at Damascus, then became Court doctor to a Syrian emir. He is best known for his biographical lexicon of Mohammedan physicians, which has been edited by August Müller (Königsberg, 1884), and commented on by the same in *Ueber Ibn Abi und seine Geschichte der Aerzte* (Leyden, 1885). Consult: Wüstenfeld, *Geschichte der arabischen Aerzte und Naturforscher* (Göttingen, 1840); Leclerc, *Histoire de la médecine arabe* (Paris, 1876); *Travaux de la VIème session du Congrès international des Orientalistes à Leide*, vol. ii. (Leyden, 1884).

IBN AL-ATHIR, ĭb'n ȧl-ȧ-tēr', Izz-ad-Din al-Jazari (1160-1230). An Arabic historian, who was born of good family in Mesopotamia, and lived in Mosul. He wrote *Kâmil*, a history of the world to the year 1231, edited by Tornberg under the title *Ibn-el-Athiri Chronicon quod Perfectissimum Inscribitur* (1851-76); *Usd al-ghâba*, on the successors of Mohammed (1864); and a lexicon, edited by Seybold (Weimar, 1896). Excerpts from his other works may be found in Reinaud, *Historiens des croisades* (Paris, 1829).

IBN ARABSHAH, ĭb'n ä'rȧb-shä', Ahmed (1388-1450). An Arabic author, born at Damascus. He was carried captive with his family (1400) to Samarkand, after the invasion of Syria by Timur; took advantage of this opportunity to study Turkish and Persian; traveled through Mongolia and Astrakhan; and at Adrianople was employed by the Sultan to translate Arabian writings into Turkish and Persian. The most important of his works is the biography of Timur or Tamerlane (last ed., Calcutta, 1818). The book of anecdotes written by him has been published by Freytag, with a Latin translation, under the title *Fructus Imperatorum et Jocatio Ingeniosorum* (Bonn, 1832-52).

IBN BADJA, ĭb'n bä'jȧ. See Avempace.

IBN BATÛTA, ĭb'n bȧ-to͞o'tȧ, Abu Abdallah Mohammed (1304-77). An Arabic traveler. He was born at Tangier, Morocco, and spent many years in traversing Western and Central Asia, large portions of Africa, Russia, India, China, and Spain. For three and one-half years he acted as cadi at Delhi and in the Maldive Islands. After his travels he settled in Morocco. His narrative of his journeys, replete with graphic and picturesque description, has been published in the French translation by Defrémery and Sanguinetti (Paris, 2d ed. 1874-77). There is an English translation from an epitomized version by S. Lee (1829).

IBN DOREID, ĭb'n dô-rä'ēd, Mohammed (838-933). An Arabic poet and scholar, born at Basra, and later resident in Oman, Persia, and Bagdad. His most famous poem is the elegy entitled *Alkasida-al-Maksura*, dealing with the question of good luck and bad. Among his philological works may be mentioned an etymological and genealogical dictionary of Arabic proper names, edited by Wüstenfeld (1853-54), and two briefer studies in lexicography, edited by Thorbecke (1882).

IBN HISHAM, ĭb'n hē-shäm', Abu Mohammed Abd al-Malik (c.760-833). An Arabic scholar of Basra. He is famed for his genealogical writings and his revision of the life of the Prophet Mohammed, written by Ibn Ishak (c.700-768). The biography was edited by Wüstenfeld (Göttingen, 1858-60), and translated into German by Weil as *Das Leben Mohammeds* (1864).

IBN JANACH, ēb'n hȧ-näch', Abulwalid Merwan, or Jonah Marinus. A Jewish grammarian of Spain. He was born near the end of the tenth century and died about the middle of the eleventh century, but the exact dates are unknown. He studied Hebrew at his birthplace, Cordova, and in Lucena, under Jewish teachers, and also took up the study of medicine. In 1012, in consequence of political disturbances, he was obliged, with many other Jews, to leave Cordova and settled in Saragossa, where he appears to have spent the rest of his days, and where, while continuing his practice of medicine, he devoted himself also to the investigation of Hebrew grammar, guided largely by the researches of his predecessor, Hayyug (q.v.). Ibn Janach was enabled to advance the knowledge of Hebrew morphology far beyond the point that Hayyug had reached. He did not hesitate to make slight changes in the biblical text where it seemed to be meaningless as it stood. His main work consists of two parts, the first dealing with grammar, *Kitâb-al-Luma*, published by J. Derenbourg (Paris, 1886); the second a lexicon, *Kitâb-al-'Usûl*, published by Neubauer (Oxford, 1873-75). The grammar, based on Arabic models, is the first systematic attempt to cover the entire field of Hebrew grammar. The dictionary is characterized by the same comprehensive knowledge and clear perception as the grammar, and, incidental to the explanation of words, furnishes valuable and elaborate discussion of grammatical points. Both the grammar and the dictionary were translated by Judah ben Saul Ion Tibbon (c.1120-1190), the former having been published by B. Goldberg (Frankfort, 1856); the latter by W. Bacher (Leipzig, 1889). He also wrote several minor grammatical treatises (published by J. and H. Derenbourg, Paris, 1880), in which he defended his views and those of Hayyug against attacks, and also amplified the grammatical treatises of the latter. Ibn Janach was also interested in philosophical questions, and strenuously opposed the speculations of Ibn Gebirol and other men of the day on the relation of God to the world, on the ground that they led to disbelief. Consult Bacher, *Leben und Werke des Abulwalid Merwan ibn Ganach* (Leipzig, 1885).

IBN KHALDUN, ĭb'n ᴋȧl-do͞on', Abd ar-Rahman (1332-1406). An Arabic historian, born at Tunis, of a family from Seville. He early entered the public service, first in Tunis, then under the ruler of Fez. In 1362, under the Sultan of Granada, he carried on negotiations for peace with Pedro of Castile; in 1374 was imprisoned in Northern Africa, where he was intriguing, but returned home in 1378. Four years afterwards he set out for Mecca; on his way stayed three years in Egypt, whither he returned after the pilgrimage, and where he lived for a few years before he took service under Timur in Syria. His historical work is the first among the Arabs to leave the annalistic method, and the introduction especially is conceived in a philosophic manner. Besides this introduction, edited by Quatremère (Paris, 1858), and translated into French by De Slane (Paris, 1862-68), the work has two main divisions—the history of the eastern caliphate, partly edited, with Latin translation, *Ibn Khalduni Narratio de Expeditionibus Francorum*, by Tornberg (1840), and the account of the Berbers and the dynasties of North Africa, edited and translated into French by De Slane (Paris, 1862). Consult Kremer, *Ibn Chaldûn und seine Kulturgeschichte der islamischen Völker* (Vienna, 1879).

IBN KHALLIKAN, ĭb'n ᴋä'lē-kän', Shams ad-Din Ahmed (1211-82). An Arabic historian, born at Arbela, of the family of the Barmecides. He held important offices in Cairo and in Damascus, where he died. His most important work is a biographical dictionary, a very important source of knowledge of Arabian literature and its history from the eighth century to his own time. It is edited by Wüstenfeld (Göttingen, 1840-65), and translated into English by MacGuckin de Slane (London, 1842-71).

IBN KOTEIBA, ĭb'n kō-tā'ē-bȧ, Abdallah (828-c.889). An Arabic philologist and historian. He was born probably at Bagdad or Kufa, and for some time held high judicial offices at Dīnâver. Later he was a teacher in Bagdad, and died there. Of his works, the most important are: *Adab al-Kâtib*, mainly philological, and of great value on literary style and on antiquities, of which Sproull published a part as *An Extract from Ibn Koteiba's Adab al-Kâtib* (1877), and which was edited by Grünert (1900); a collection of biographies of the Arabian poets, of which only the introduction has been published, by Rittershausen, with Dutch translation (1875); *Kâtib al-ma-Arif*, an outline of history for practical use, edited by Wüstenfeld (1850); and *Uyun al akhbâr*, a treatise upon government, war, nobility, character, science, friendship, food, women, and other topics, edited by Brockelmann (Weimar, 1898).

IBN-ROSHD, ĭb'n rôsh't. See Averroës.

IBN SAYIG, ĭb'n sī-ēg'. See Avempace.

IBN SINA, ĭb'n sē'nȧ. See Avicenna.

IBN TOPHAIL, ĭb'n tŏ'fȧ-ēl. See Abu-Bekr Mohammed Ibn Tophail.

IBN ZOAR, ĭb'n zōr, or **IBN ZOHR.** See Avenzoar.

IBOS, ē'bōz. Dominant negro people of the Niger Delta. Slaves from this region formerly were called 'Ibo.' Their language is akin to the Ewe and the Tshi.

IBRAHIM, ē'brȧ-hēm' (1615-48). An Ottoman Sultan, third son of Ahmed I. On the death (1640) of his brother, Amurath IV., whose cruelty he had escaped by feigning madness, he came to the throne. His short reign was filled with excess, debauchery, and prodigality. In 1645 he attacked the island of Crete, which was then under the control of Venice, but did not live to finish this war, which was the result of an intrigue in his harem. His government was so cruel and the taxes so oppressive that in 1648 the Janizaries rebelled and dethroned him, and strangled him a few days later.

IBRAHIM, OU L'ILLUSTRE BASSA, ē'brȧṳ'ɴ' o͞o lē'lṳs'tr' bȧ'. A romance by Mademoiselle de Scudéry, originally published under the name of her brother (1641).

IBRAHIM PASHA, ē'brȧ-hēm' pȧ-shä' (1789-1848). An Egyptian general. He was the adopted son of Mehemet Ali (q.v.), Governor and subsequently Viceroy of Egypt, and was born at Kavala, in the Province of Saloniki, in European Turkey. In 1816 he led an army into Arabia, and in the course of three years overthrew the Wahabi power in Western Arabia and in Nejd. During the War of Greek Independence he was dispatched at the head of a powerful fleet and a finely disciplined land force to the aid of the Turks in the Morea. In 1825 he stormed Navarino and Tripolitza, and in the following year took Missolonghi, after a long siege. The destruction of the Turkish-Egyptian fleet in the harbor of Navarino, October 20, 1827, and the landing of a French force, led to the evacuation of the Morea by Ibrahim in September of the following year. As the result of a dispute with the Pasha of Acre, an Egyptian army under Ibrahim invaded Syria in 1831, stormed Acre, May 27, 1832, and defeated the Turkish forces at Homs, Beilan, and Konieh. By the Treaty of Kutayah, May 14, 1833, Mehemet Ali received possession of Syria, while Ibrahim was made Governor of Cilicia. War with the Porte broke out again in 1839, and on June 24th of that year Ibrahim overwhelmed the Turkish army at Nisib, near the Euphrates. Only the interference of the Great Powers saved the Porte from the victorious armies of Mehemet Ali. Ibrahim was forced to evacuate Syria in 1840 and to return to Egypt, suffering the most severe hardships on his march through the desert. He died at Cairo, November 10, 1848, after acting for some months as Regent during the incapacity of Mehemet Ali. His son, Ismail Pasha (q.v.), subsequently became Khedive of Egypt.

IBRAIL, ē-brä'ēl. See Braïla.

IBSAMBUL, ēb-säm′bōōl. A noted group of ruins on the Nubian Nile. See ABU-SIMBEL.

IBSEN, ĭp′sen, HENRIK (1828—). A Norwegian dramatist, born at Skien, March 20, 1828, whose influence is marked in German, French, English, and Italian literatures. His great-grandmother was Scotch, his grandmother and mother German, his grandfather's grandfather Danish. They were a family of shipmasters. His father, Knud Ibsen, a merchant, met with reverses in Henrik's boyhood, which compelled the youth to pass six years (1836-42) in great poverty. In the latter years of this period he attended a scientific school at Skien, and late in 1843 he became an apothecary's apprentice at Grimstad, where he remained till 1849 writing a *Catiline* in three acts (published 1850), and some poems. He now sought the University of Christiania to learn medicine, but in 1850 he was diverted by the successful production at Christiania of his *The Warrior's Mound* from academic studies to the drama. In 1851 he helped to found a short-lived weekly, *Man*, in which appeared his political satire, *Norma*. In November he was appointed stage manager at Bergen, with leave of absence for three months to study the art he was to practice. These he spent in Germany, writing the unsuccessful and unpublished *Saint John's Night*. In 1856 *The Banquet at Solhaug*, the first of his national dramas, was produced in the theatrical centres of Norway and Sweden. It won him enthusiastic applause and national renown. In 1857 he became director of the Norwegian Theatre at Christiania, but five years of his management reduced it to bankruptcy. Here were produced *Lady Inger of Ostraat*, a saga drama (1855); *The Vikings at Helgeland* (1859); and *Love's Comedy* (1862). In this period he wrote also the longest of his minor poems, *On the Mountain Plains* (1860). In 1862, after the bankruptcy of the theatre, Ibsen accepted from the university small grants for researches in folklore and in 1863 petitioned the Storthing for the Poet's Pension (about $450). He received in 1864 a Traveling Scholarship and the Pension in 1866. Meantime, embittered by delay and the political situation, he left for Rome in April, 1864, whence he sent back (1866) the social satire, *Brand*. In 1868 Ibsen left Rome for Dresden, where he remained till 1874. After a voluntary exile of ten years, he went back to Norway. In 1891 Ibsen made Christiania his home. On his seventieth birthday the poet-dramatist received gifts and greetings from everywhere in the world. A bronze statue of him was set outside the new National Theatre in September, 1899. His influence has not been so widespread in the United States as in Europe.

Besides the dramas above named, Ibsen's works include: *The Pretenders* (1864), an historical drama; *Brand* (1866) and *Peer Gynt* (1867), dramatic poems; *The League of Youth*, a political comedy (1869); the bulky two-fold historical drama, *Emperor and Galilean* (1873); and, beginning with 1877, the yet better-known series of dramas that are more characteristic of what passes for Ibsenism: *The Pillars of Society* (1877); *A Doll's House* (1879); *Ghosts* (1881); *An Enemy of the People* (1882); *The Wild Duck* (1884); *Rosmersholm* (1886); *The Lady from the Sea* (1888); *Hedda Gabler* (1890); *Master Builder Solness* (1892); *Lille Eyolf* (1894); *John Gabriel Borkman* (1896); *When We Dead Awaken* (1900). Ibsen's dramatic work had been at first romantic. This phase culminated in the *Banquet at Solhaug*. Then it was historic, but still romantic, up to the *Vikings at Helgeland*. Next the psychologic interest becomes prominent, and with it a tendency to social satire very marked in *Love's Comedy*, a masterpiece of swift action and of biting irony. The dramas from 1864 to 1867 are polemically national rather than social. *The League of Youth* marks the transition from political to social interests. From this time on Ibsen is a pathologist of social ills, dealing, as he does, with conditions universal to modern life, and thus winning an ever widening cosmopolitan audience. All these latter plays have been several times translated into English, best, so far as he goes, by William Archer (6 vols., 1890-92). Of comment there is cloud rather than illumination. By some Ibsen's work is assailed as immoral, cynical, pessimistic, unfit to be seen or read; by others it is hailed as a new gospel of truth and emancipation. It is not wholly either. The plays are studies in human responsibility under modern social conditions, which, in many points, Ibsen considers dangerously diseased and as threatening the whole body with a gangrene. So he has become the poet of protest, the unveiler of sophistries, the scourger of hypocrisies. He writes of vice, but it is with loathing. He lays bare the cause of evils, but leaves it to others to prescribe the remedy.

But leaving the moral question aside, these social dramas mark a new stage in the evolution of dramatic art. It is a drama of descending, not ascending action, not of preludes, but of consequences. The plays are apt to begin with their climax. They are thoroughly realistic, absolutely unconventional. Their dialogues are so natural as to give the illusion of real though fascinating conversation which the playwright allows his audience to overhear. It would be hard to match them in any literature. Hence their power has been felt throughout the dramatic and literary world, while the realistic dramas of the French naturalistic school, of the Goncourts and Zola, have been regarded with languid curiosity as the products of artistic theory. For Ibsen's life, consult: Jaeger, *Henrik Ibsen: A Critical Biography* (Chicago, 1894); for summaries and comment on the dramas, Boyesen, *Commentary on the Writings of Henrik Ibsen* (New York, 1894); Shaw, *The Quintessence of Ibsenism* (London, 1893); Wicksteed, *Four Lectures on Ibsen* (ib., 1892); and Archer, "The Real Ibsen," in *International Monthly* (ib., 1901).

The German Ibsen literature native and translated is very extensive; among the more noteworthy and recent contributions to it are: Brahm, *H. Ibsen* (Berlin, 1887); Andreas-Salome, *Ibsens Frauengestalten* (Berlin, 1892); Wörner, *Ibsens Jugenddramen* (Munich, 1895), and *H. Ibsen* (Munich, 1899 seq.); Jäger, *H. Ibsen* (Swedish, Christiania, 1892; German, Dresden, 1897); Von Haustein, *Ibsen als Idealist* (Leipzig, 1897); Garde (translated by Küchler), *Der Grundgedanke in Ibsens Dichtung* (Leipzig, 1898); Brandes, *H. Ibsen* (Copenhagen, 1898); Reich, *Ibsens Dramen* (Dresden, 1900); Litzmann, *Ibsens Dramen* (Hamburg, 1901).

IBYCUS, ĭb′ĭ-kŭs (Lat., from Gk. Ἴβυκος, *Ibykos*). A Greek lyric poet of the sixth century

B.C., born at Rhegium in Italy. He lived the life of a wandering minstrel, and passed some time at the Court of Polycrates, the tyrant of Samos. The story of his death near Corinth, and the detection of his murderers by means of a flock of cranes, which has been so beautifully told by Schiller in *Die Kraniche des Ibykus*, is based on a similarity between the name of the poet and the Greek ἴβυξ, 'a crane.' Of his poems, which were mostly of an erotic character, only fragments have been preserved. These are published by Schneidewin, *Ibyci Rhegini Carminum Reliquiæ* (Göttingen, 1833); and in Bergk, *Poetæ Lyrici Græci*, iii. (Leipzig, 1882).

ICA, ē′kȧ. A maritime department of Peru, bounded by the departments of Lima and Huancavelica on the north, Ayacucho on the east, Arequipa on the southeast, and the Pacific on the southwest (Map: Peru, B 6). Area, 8718 square miles. The surface is of varied formation. The eastern part is mountainous, the western is lower and traversed by ridges of low hills. The climate is hot and dry, and the soil, with the exception of the valleys, is thin. The vine and sugar-cane are cultivated extensively; corn, cotton, and indigo are also raised. The population was officially estimated, in 1896, at 90,962. Capital, Ica.

ICA. The capital of the Peruvian department of the same name, situated on the river Ica, 46 miles by rail from Pisco on the coast (Map: Peru, B 6). It manufactures wine and brandy. It was founded in 1563, and has suffered greatly from earthquakes. Population, estimated at 10,000.

IÇÁ, ē-sä′, or **PUTUMAYO**, po͞o′to͞o-mä′yō. An important tributary of the Amazon. It rises in the Colombian Andes, and flows southeasterly in a very tortuous course, joining the Amazon near San Antonio in the Brazilian State of Amazonas (Map: Brazil, D 4). Its total length is about 1000 miles, and it is navigable during the rainy season for nearly 900 miles. The region through which it flows is very sparsely inhabited and covered mostly with thick forests, so that at present the commercial value of the river is unimportant. The Içá was partly explored in 1878-79.

ICARIA, ĭ-kā′rĭ-ȧ (Lat., from Gk. Ἰκαρία, *Ikaria*). A deme of Attica, where excavations were carried on by the American School at Athens in 1888, when many interesting remains were found. Icaria is noted as the birthplace of Thespis, and as the spot to which legend assigns the introduction of wine-making and of the cult of Dionysus by the god himself.

ICARIA. An island of the Ægean. See Nicaria.

ICARIANS. Members of a communistic society, founded by Cabet (q.v.) to realize the ideals set forth in his romance *Voyage en Icarie*. During the years preceding the Revolution of 1848 communistic doctrines had a wide following in France; and when, in 1847, Cabet announced the acquisition of land in Texas, a large number of persons agreed to emigrate with him to found a settlement there. In 1848 sixty-nine persons set out for the colony, but were unable to endure the climate, and returned after a few months to New Orleans, where they were joined by Cabet with 400 more. Early the following year Cabet, with about 300 followers, emigrated to Nauvoo, Ill., then recently deserted by the Mormons, where the colony was moderately prosperous for a few years, undertaking agriculture as well as trades and manufactures. Dissensions arose, and in 1856 Cabet was expelled together with those members of the community who supported him. In 1860 financial difficulties rendered it necessary for the remaining Icarians to abandon Nauvoo, and thirty-five of them founded a new settlement in western Iowa. For twenty years they grew in wealth and numbers; but in 1880 the community split into two factions, the Young and the Old Party. The former soon broke up; the latter existed until 1895, when it, too, was dissolved. In 1881 a few members of the Iowa community went to California, where they established Icaria Speranza, a society, however, more like a business corporation than a communistic settlement.

The organization of the Icarian communities was democratic. Directors were elected, but they could only execute the orders of the whole body. The members lived in little houses around a central hall where they took their meals in common. They were sociable in their habits, took great pains to educate their children, and were remarkable for their thrift, industry, and the good order they maintained. Excluding the purely religious communists, the Icarian settlements were by far the most successful of the communistic experiments of which the early nineteenth century was so prolific. Consult: Lux, *Etienne Cabet und der Ikarische Kommunismus* (Stuttgart, 1894); Shaw, *Icaria* (New York, 1884).

ICA′RIUS (Lat., from Gk. Ἰκάριος, *Ikarios*). (1) In Greek mythology, an Athenian to whom Dionysus taught the cultivation of the vine. (2) A Lacedæmonian, the father of Penelope, wife of Odysseus. When Odysseus declined to settle at Lacedæmon as desired by Icarius, and gave Penelope her choice of following him to Ithaca or of remaining with her father, the bride covered her face with her veil and chose her husband. Icarius then ceased his solicitations and raised a temple to Modesty on the spot.

IC′ARUS. See Dædalus.

ICAZBALCETA, ē′käth-bäl-sā′tȧ, Joaquin Garcia (1825—). A Mexican author. He was born in the City of Mexico, and began his historical and archæological researches at an early age. His first literary work was done in the preparation of the *Diccionario universal de historia y geografía* (1885), and he afterwards published a *Colección de documentos para la historia de México* (1858-66), and *Historia eclesiástica indiana, obra escrita á fines del siglo XVI. por Francisco Gerónimo Mendieta de la órden de San Francisco* (1870).

ICE (AS., OHG. īs, Ger. *Eis*). Water in the solid state. It is crystallized in the hexagonal system. Ordinarily the crystalline structure of a block of ice is not apparent, owing to the close contact and perfectly regular arrangement of the crystals. But when a piece of ice is exposed to radiation from any luminous source, as the sun, a glowing fire, a gas or oil flame, disintegration gradually takes place, and by the use of a lens, numerous small crystals may be seen studding the interior of the block; as the heat continues, these crystals expand and finally assume the shape of six-rayed stars of exquisite beauty. (See article Snow.) The freezing-point of pure water is marked 0° on the Centigrade and Réaumur scales, and 32° on the Fahrenheit scale. The influence of changes of pressure on the freezing-point is so slight that for all ordinary atmospheric pressures the freezing-point of pure water may be considered a constant quantity. Great pressures, however, have the effect of lowering the freezing-point very considerably, and by raising the pressure to many thousand pounds per square inch ice has been caused to melt at 0° F. By cooling pure and clear water cautiously, it may be 'undercooled,' i.e. it may, under ordinary pressure, be obtained in the liquid state at temperatures several degrees below its normal freezing-point. But this is quite different from the effect of high pressures; the state of 'undercooled' water is just as unstable as the state of a 'supersaturated' solution, and a slight disturbance may cause the whole mass to freeze very rapidly, just as it may cause rapid crystallization to take place in a supersaturated solution. The lowering of the freezing-point by pressure has furnished one of the theories explaining the motion of glaciers. This 'regelation theory' is illustrated by the following phenomenon: If a wire holding heavy weights at its ends is thrown over a block of ice, it gradually cuts its way through the block, and yet the latter remains entire. Along the line where the wire presses upon the block, the melting-point is lowered, and hence the ice melts and allows the wire to descend through a minute distance; the water immediately above the wire then freezes, because it is freed from pressure, and at the same time the ice immediately below the wire melts, allowing the wire to descend a little farther. Thus melting and almost immediate regelation proceed until the wire has cut through the block. The freezing-point of water, as that of any other liquid, is considerably lowered by dissolving in it substances of any kind, and sea-water, on account of its salt, is found to freeze at —2.5° to —3.0° C. The solid separating out, under ordinary circumstances, from freezing sea-water, is not a mixture of ice and salt, but pure ice, and this fact has been utilized in two ways: (1) for concentrating brine in the manufacture of salt; (2) for obtaining sweet drinking-water from the salt water of the sea.

Unlike most other substances, water, on passing from the liquid to the solid state, does not contract, but expands. Therefore ice, having a lower specific gravity than water, floats on its surface. The specific gravity of ice at its normal melting-point is 0.918. The specific heat of ice, i.e. the amount of heat required to raise its temperature 1° C., is much less than that of water in the liquid state; within 30° C. below the freezing-point it is very near one-half, and at lower temperatures it is even somewhat less than one-half, that of water. In the process of melting, ice absorbs more heat than any other solid (see Freezing-Mixtures), more than 80 calories being required to melt one gram of ice; the same amount of heat would raise the temperature of the gram of melted water to 80° C. (176° F.).

Ice-Pack, or Pack-Ice. A name given to the large sheets or pans of ice (*floes*) which have united to form a *pack*, and which occupy the open surface of the sea. The ice is almost wholly the result of direct freezing of the superficial stratum of the ocean, continued through a succession of years to a possible thickness of 16 to 20 feet, and of snow accumulations on this surface. Through 'shearing' and over-riding the ice-pack is frequently of greater thickness than would be brought about by freezing alone, and it is not rare to meet with 'hummocks' on the borders of the pack 30 to 40 feet in height, and more. The individual pans, sheets, or floes that help to build up the pack are of varying dimensions, ranging from small cakes to solid sheets many miles across, and a pack itself may measure a hundred miles, or even considerably more. Even where virtually unbroken, they may contain here and there pockets or 'lakes' of inclosed water, and penetrating water-ways (*leads*), connecting these lakes or wholly independent of them, are of common occurrence. The central part of the Arctic Basin is frequently assumed, but perhaps without sufficient reason, to be occupied by a stationary pack; along its southern border it is freely moving, sending down those vast sheets of ice which constitute the 'pack-drift.' The remarkable drift of the *Fram* has demonstrated that the northern pack was still moving close to the 86th parallel of north latitude, or within less than 300 miles of the Pole. The strong southerly drift of the pack-ice in the region about Greenland, Grinnell, and Grant Lands, jamming between the opposing land-masses, is that which has so largely baffled exploration along what is known as the 'American route' to the Pole. The great centrally located ice-mass which in Davis Strait and Baffin's Bay separates Greenland on the east from the disconnected lands of Arctic and sub-Arctic America on the West, is known by whalers and others as the 'Middle Pack.'

The Antarctic pack is less thoroughly known than the Arctic, although its extent appears to be very much greater, and during many years its front edge or that of the pack-drift has passed far beyond (northward of) the Antarctic Circle. Various names have been given by navigators to particular conditions of ice. The border of sea-ice which clings to the land, and is not affected by the movements of tides, is called the *ice-foot*. Ice that has been crushed into fragments by the impact of moving floes is called rubble. A piece of ice that floats with the upper surface just awash is called a *growler*. *Anchor-ice* or *ground-ice* is fresh-water ice that has frozen to the bottom of a lake or river. *Young ice* is ice new-formed, in distinction from ice of previous seasons. *Palæocrystic ice* is ice that has been formed during a number of seasons by floes overlaid one upon another, has been increased year by year by snowfall, and has been welded by sun and rain into a single mass. See Arctic Region; Antarctic Region.

Iceberg. Under this name is understood a detached fragment or section of a glacier, whose terminal foot has reached a body of water, whether fresh or salt, and there broken (calved) off. Fresh-water bergs are those of lakes, and are of comparatively rare occurrence, and never of large size. The oceanic bergs, on the other hand, are frequently of very great size; they may measure even miles in length, as those of parts of the Antarctic waters and even of Melville Bay, off the west coast of Greenland; and they not infrequently rise 250 or even 300 feet above the surface of the sea. In the case of the flat-topped or even-formed bergs it can readily be inferred from the specific gravity of ice that they at times descend fully 1200 to 1500 feet, or more, into the abyss of the ocean; and it is a common condition to find the larger bergs 'stranded' or anchored at this depth to the floor of the sea. The pinnacled or fancy-shaped bergs are usually those which have undergone considerable weathering or beating up by the sea, and are thus necessarily of smaller size than those of even contour. It is a common statement that the Antarctic bergs differ from those of the Arctic by their larger and more generally tabular form; but these differences are not fundamental, and are hardly more than comparative. But it may be questioned whether all the larger detached masses of ice in the Antarctic Ocean are, indeed, true glacial bergs; many of them might well be only accumulated sea-ice, formed by accretional growth, independent of any assisting land-mass.

The source of practically all the icebergs of Arctic and sub-Arctic waters is Greenland, from whose ice-cap and névé radiate off hundreds of glaciers, the vast majority of which—at least those of larger size—reach the sea, either directly or through the long fjords which extend 20 to 70 miles into the land. One or more of the glaciers of Melville Bay present ocean fronts of 25 or 30 miles, and there are a number of nearly equal size in Western, Southwestern, and Eastern Greenland.

Owing to the northward set of the West Greenland current, the bergs of this side are carried first to the north, and it is only at about the 74th or 75th parallel that they begin to make their way westward to come down on the 'American side.' Many of the East Greenland bergs follow in the trail of these, rounding the southern apex of the great insular land-mass. The lowest point reached by the bergs in North-Atlantic waters is about 40° in the western half of the basin; eastward, the zone of distribution, following largely in the course of Gulf-Stream drift, rises sharply northward, and entirely clears the coast of Scandinavia.

Icebergs are apt to carry much debrital material with them, the remains or parts of the glacial moraines which were formed on land. These, on the melting of the ice, naturally find their way to the bottom of the sea, whether deep or shallow, and these help to build up a 'bowlder-clay deposit,' somewhat similar to the basal till of glaciers. The stranding of bergs on rock-masses also tends to bring about grooving and polishing, again similar to what is produced by moving land-ice (glaciers). Consult Tyndall, *The Forms of Water in Clouds and Rivers, Ice, and Glaciers* (New York, 1872). See Water; Melting-Point; Freezing-Point; Glacier; Refrigeration.

ICE, Law of. After ice has been harvested it is personalty, and is subject to the rules of law governing that form of property. Before it is harvested it is deemed realty for most purposes, although some courts have held that a contract for the sale of all the ice on a certain pond is to be treated as a contract for the sale of a chattel, and not of an interest in real estate.

If the land beneath a particular body of water is subject to private ownership, the ice that forms on the water belongs to the owner of such land, and he has exclusive authority to gather or dispose of it. Hence a lease of the land or a conveyance of the fee carries to the tenant or to the grantee the ownership of the ice which forms during the term of the lease, or which exists at the date of the conveyance. It is in the nature of an accession to the land, being an increment arising from a formation over it, and is a part of the real estate under the rule that the ownership thereof extends indefinitely upward from the soil.

The landowner may grant to another the right to take ice from private waters, as a profit *à prendre;* that is, as a right to take the products or proceeds of land. Accordingly, the grant of a half-acre of land adjoining a mill-pond with the exclusive right to take the ice from the pond attaches this right as a profit *à prendre* to the half-acre, and it will pass to a second grantee of the half-acre as an appurtenance thereto. On the other hand, the landowner does not part with his right to ice which forms upon a mill-pond by granting to the mill-owner the privilege of flooding the land in question and maintaining a pond thereon. The ice attends the ownership of the soil, not the easement of covering it with water; and if the mill owner needlessly draws off the water for the sole purpose of destroying the ice or preventing its formation, he is liable in damages to the landowner. Again, the owner of land under a private stream is entitled to dam the stream and take ice therefrom, provided such use does not unreasonably interfere with the rights of riparian owners below him to the use of the water.

A riparian owner's right to ice on navigable rivers depends upon his ownership of the land under them. In States where the fee of such rivers is vested in the public the adjoining landowner has no title to the ice, and it belongs to the first appropriator. In other States, where riparian owners are accorded title to the land under navigable waters, they can maintain trespass against any one taking the ice without their consent. At times ice-covered streams or lakes are used as highways of travel, and the question has arisen whether the harvesting of ice upon such a thoroughfare amounts to a nuisance, as an unlawful obstruction to travel. The courts have given this answer: In the absence of legislation on the subject, the right of travel and the right of harvesting ice on navigable waters are public and are to be exercised reasonably. What is a reasonable use of either right depends upon the relative benefits to the community from its exercise. If the privilege of harvesting ice is of greater importance than that of traveling upon it, the latter cannot be set up to prevent or abridge the exercise of the former.

The right to harvest ice forming upon public waters is not private, but public or common. Any citizen may enter such ice fields and take what he pleases, so long as he does not unlawfully interfere with the like right of others. What acts amount to an appropriation of ice on public waters is a question upon which the courts are not agreed. One view is that an appropriation is made by marking and staking off a plot of ice, and preparing the surface for cutting. The other view is that a person does not gain any property rights in such a plot of ice until he has actually reduced it to possession. The subject is regulated in some States by statute. Consult: Gould, *The Law of Waters, Including Riparian Rights* (Chicago, 1900);

Coulson and Forbes, *The Law Relating to Waters* (London, 1902); and the statutes of the various States.

ICE AGE. See GLACIAL PERIOD; PLEISTOCENE PERIOD.

ICE-BEAR. The polar bear. See BEAR.

ICEBERG. See ICE.

ICE-BREAKING STEAMER. A vessel used for keeping open a navigable passage through ice. Such vessels are much used on the Great Lakes of the United States, where they are usually adapted for carrying cargoes or railway cars. They are very heavily built to stand the shock of ramming the ice or of running up on it at the bow and breaking it by reason of their weight. During the past few years the problem of constructing such vessels has been studied by Admiral Makaroff, of the Russian Navy, and several vessels have been built from his designs. The largest of these was built in England in 1898-99, and is called the *Yermak.* She is of 8000 tons displacement and has four screws, one under the overhanging bow to suck down the ice, so that the bow will ride over it, and, descending, crush it. This screw also creates a current which drives the broken ice astern. The stern is recessed to receive the bow of a vessel following her through the channel which she makes. Her length is 305 feet; beam, 71 feet; and draught, 25 feet. The coal capacity is very great—3000 tons—as it was intended to use her in Arctic exploration; she spent some months in the Arctic Ocean during the summer of 1900, and was very successful in breaking her way through ice-fields in harbors; but in 1901, against the heavy ice of the polar pack, she proved inefficient.

ICE-CAVE. Any natural formation of ice in a cave or crevice. The walls of caves often become cooled to such a point by the infiltration of cold air in winter or during the frosty nights of spring and autumn, that the percolating waters rapidly freeze. The ice usually disappears for a few weeks in September. The most celebrated ice-cave in the world is that of Dobschau (Dobsina), in Hungary, situated in the Carpathians, at an elevation of about 2700 feet. Consult Balch, *Glacières or Freezing Caverns* (Philadelphia, 1900).

ICE-COLUMNS. See FROST.

ICE-GULL. A name given to several gulls encountered by sailors in icy regions, most properly perhaps to Ross's gull. See GULL.

ICE INDUSTRY, THE. The ice industry is divided into two branches, in accordance with the origin of the ice itself. *Natural ice* is cut in winter from rivers, lakes, and ponds, stored in ice-houses, and distributed to consumers as needed. Manufactured ice, or, as it is more commonly called, *artificial ice*, is produced when and where required, and is generally distributed with comparatively little intervening storage. The collection and preservation of ice and snow, on a scale which was small indeed as compared with the operations of the present day, appear to have been practiced from early times by most civilized nations having the natural products within their reach. Where neither snow nor ice was provided by nature, various means of artificial production have been practiced in a small way for centuries; such as the exposure of water in porous receptacles, and packing common or some other kind of salt about vessels containing water. But the modern ice industry began in the United States early in the nineteenth century, with the transportation of ice in sailing ships from cold northern to warm southern ports; and the production and sale of manufactured ice has, within the last twenty-five or thirty years, attained large proportions and made an ample and cheap ice-supply quite independent of local temperatures.

NATURAL ICE. It is said that both the Greeks and the Romans packed snow in deep underground pits, and that Nero established ice-houses in Rome. At the end of the seventeenth century dealers in ice and snow were quite common in France. In 1799 a cargo of ice, cut from a pond near Canal Street, in New York City, was shipped to Charleston, S. C. This may be considered as of little moment; but in the winter of 1805-06 Frederick Tudor, of Boston, Mass., entered the ice field in good earnest, and, after some heavy losses, succeeded in establishing an export trade in ice which was the beginning of the modern industry. Tudor's first ice cargo, of 130 tons, was shipped from Boston to Martinique in the winter of 1805-06, but though the ice reached its destination in safety, the venture resulted in a loss. Two years later a shipment of 240 tons to Havana, Cuba, also resulted in a loss to Tudor. A monopoly of the ice trade with the British West Indies was secured by Tudor about 1816, and a like privilege from Spain in 1815-16. From 1815 to 1820 the same merchant extended his ice trade to Charleston, S. C., Savannah, Ga., and New Orleans, La. Others followed his example, until in 1855 ice exports from the United States, according to statistics of the Treasury Department, amounted to 41,117 tons, valued at $190,793. These exports increased to 68,802 tons, valued at $267,702, in 1870, since which time, according to the authority already cited, there has been an almost constant decrease, until in 1900 the tonnage was only 13,720, and its value $29,501. If the figures were available it would doubtless appear that the foreign ice trade was soon outstripped by the domestic commerce in what has long since changed from a luxury to a necessity. The *Ice Trade Journal* has published figures for the harvest of Maine and Hudson River ice for the years 1878 to 1900, inclusive, which show that those two sources alone produced yearly quantities ranging from 2,226,000 tons in 1880 to 5,626,430 tons in 1899. The capacity of Hudson River ice-houses in 1900 was placed at 4,216,000 tons. The combined Maine and Hudson River yield, enormous as it may seem, is estimated at only about half the commercial product of natural ice in the United States; but even if this be not too low for the total, it should be remembered that, in the aggregate, the additional harvest for private purposes is immense.

HARVESTING ICE is a comparatively simple operation, or series of operations, the main features of which are as follows: The snow, if any, lying on the ice is removed by scrapers. In case there is an upper layer of snow ice, it is loosened by field planes and then removed. Markers are next used to outline the blocks, which are followed by plows, which cut the grooves still deeper. The scrapers, planes, markers, and plows are drawn by horses or mules. The parallel grooves, it should be understood, are first cut in one direction, then another series is cut at right angles to the first. The final grooves extend nearly through the ice, so that the cakes may readily be pried apart by means of suitable tools. When the latter operation has been effected the cakes are floated to the shore through channels provided for the purpose, and there elevators, generally inclined, lift the ice to the ice-houses. The cakes are packed close together, with sawdust or other insulating material above the final layer, and between the ice and the outer walls of the ice-house. The ice-houses are generally tall structures, with outer walls composed of one to three compartments. Probably the most approved plan is to have an outer compartment in which the air is allowed to circulate; an inner or dead-air compartment; and a central space packed tightly with sawdust. The bottom of the ice-house must be well drained, and ample provision must be made for ventilation in order to prevent the accumulation of watery vapors above the stored ice. Railway sidings, or docks, or both, afford means for shipping the ice to distributing centres. Specially constructed cars, with lined sides and bottoms, are used where ice is to be shipped long distances, and in the South the cakes are carefully packed in addition.

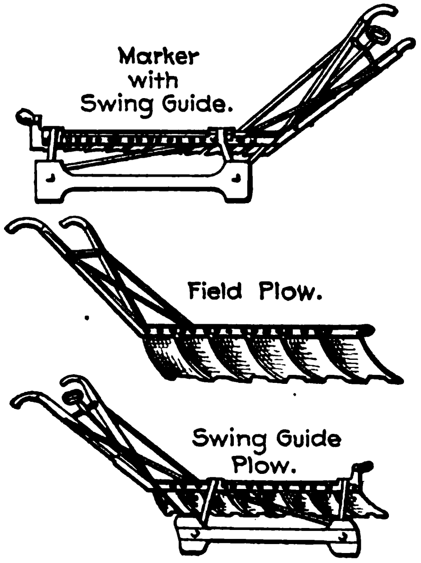

Marker with Swing Guide.
Field Plow.
Swing Guide Plow.

FIG. 1. ICE TOOLS.

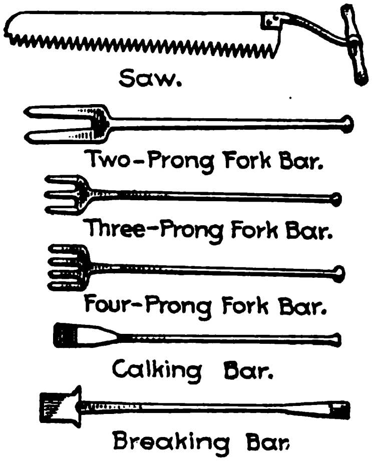

Saw.
Two-Prong Fork Bar.
Three-Prong Fork Bar.
Four-Prong Fork Bar.
Calking Bar.
Breaking Bar

FIG. 2. ICE TOOLS.

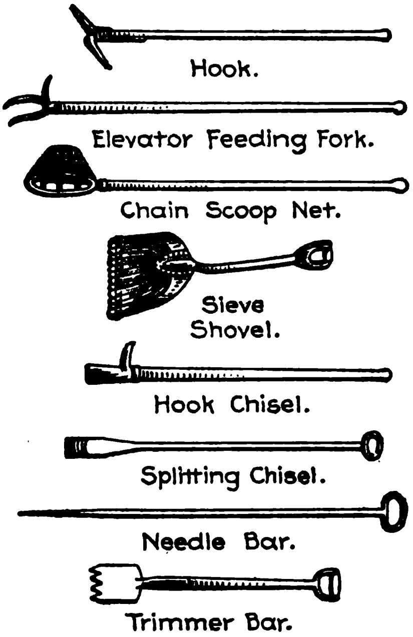

Hook.
Elevator Feeding Fork.
Chain Scoop Net.
Sieve Shovel.
Hook Chisel.
Splitting Chisel.
Needle Bar.
Trimmer Bar.

FIG. 3. ICE TOOLS.

Besides the ice tools already named (snow-scraper, ice-plane, marker, and plow) the following may be mentioned: Augers and tapping-axes for inspecting the ice and for draining it of surface water; saws; forked and pronged and chisel and needle bars, for separating the cakes after the markers and plows have done their work; trimmer bars for squaring the cakes, and hooks, grapples, and forks, for pushing them to the elevator; chain scoop-nets and sieve shovels, for removing slush ice from the channels; hoisting, drag, and edging tongs, adzes and long-handled chisels for packing the ice in the houses; saws and bars for loosening the ice preparatory to shipment from the houses; and, finally, delivery wagons, tongs, saws, axes, shaves, and scales.

ARTIFICIAL ICE. A sketch of the development of ice-making apparatus and descriptions of the principles and practices involved will be found under REFRIGERATION. The following figures regarding the growth of the industry in this country are taken from the section on the Manufacture of Ice Industry in the Twelfth Census of the United States. The first ice factory of importance in this country was erected at New Orleans in 1866. In 1870 three other factories were included in the census returns. The number of establishments reported increased to 25 in 1880, 222 in 1890, and 787 in 1900. The total capital invested in these 787 plants was $38,204,054, and the value of the products was $13,874,513. These figures, like those previously given for natural ice, do not include the hundreds of plants making ice exclusively for their own use, such as breweries and cold-storage houses. Of the 787 plants reported in 1900, 571 used the compressor, and 216 the absorption system. (See REFRIGERATION.) The total product of the 787 factories was 4,294,439 tons, of which 4,139,764 tons, or 96.4 per cent., was can ice, and only 154,675 tons plate ice. The Middle States produced more ice than any other group, the amount being 1,574,980 tons, as compared with 1,414,158 tons for the Southern States, and only 40,059 tons for the New England States. The average value of the ice at the plants, for the whole country, was $3.11 per ton for can ice, and $2.85 for plate ice. As a rule, the Southern States now depend wholly upon the manufactured product for their ice-supply, the few possible exceptions being some of the coast cities. As one goes farther North, natural ice comes more and more into competition with the manufactured article, until at the extreme North it actually, or practically, displaces the latter. But the use of manufactured ice has increased rapidly of late and is continually extending toward the North.

SANITARY ASPECTS. The sanitary quality of ice-supplies depends chiefly upon the presence or absence of disease germs, chiefly those of typhoid fever, in the original water, and upon the effect of freezing upon such germs. In addition there is the possibility that manufactured ice may become contaminated during the freezing process by sick or careless workmen, and that any ice may be fouled while it is being distributed to consumers. Proper washing of ice before domestic use, care not to bring ice in contact with food or water, and proper supervision of ice factories, would go far toward preventing danger from what may be termed incidental contamination. The water from which artificial ice is made is frequently distilled or filtered, or both. In general, it may be said that artificial ice should be made from none but naturally pure water or from that which has been purified, and that natural ice should not be harvested from polluted streams or lakes. It may be noted, however, that natural ice, when formed in fairly deep and quiet water, eliminates much of the impurities while freezing, and that recent bacterial studies show that after a few weeks practically all bacteria, and particularly the dangerous ones, disappear. Under anything like carefully guarded conditions, therefore, the chance of typhoid infection by means of ice is small. In the case of artificial ice, the freezing process, being from the outside in, concentrates the impurities at and near the centre of the cake.

BIBLIOGRAPHY. Consult Hile, *The Ice Crop* (New York, 1892); and for the sanitary aspects of the subject, consult: *Reports of the Massachusetts State Board of Health* for 1889, 1892, and 1900; the *Report of the Boston Board of Health* for 1901; and Prudden, *Drinking Water and Ice Supplies* (New York, 1900).

ICELAND. An island and Danish colony in the North Atlantic, on the northern edge of the temperate zone. The Arctic Circle cuts the two most northern points of the island, which extends south to latitude 63° 35′ N., and from longitude 13° 23′ to 24° 35′ W. (Map: Denmark, F 1). It is about 600 miles distant from Norway, and 250 from Greenland. Its area is 39,756 square miles, of which only about one-sixth is habitable. The southern coast has no indentations, but the west, north, and east coasts are broken to a remarkable extent by numerous deep fiords, skirted by many small islands. In the south the coastal lands are low and sandy, but elsewhere the coasts are frowning and precipitous.

Iceland is a land of plateaus, built up of volcanic masses of old and recent origin; formations dating from before the Tertiary Period are nowhere found. The average height of the land is from 1600 to 2000 feet. The few low grounds are small, and occupy only about one-fourteenth of the total area. Only these low grounds, the coasts, and some narrow valleys are inhabited, while the extensive highlands are quite unfit for settlement; the outer edges only are utilized as summer pastures for sheep. Basalt and volcanic breccia are the component rocks; the latter is found in the centre and extends down to the south, while the greater part of the west, north, and east coasts consists of basalt.

Above the elevated plains of the interior rise the broad domes of the ice-covered mountains; the largest of them rest on breccia, and where the glaciers descend almost to the sea, as on the south coast, there are no fiords or harbors, for these have been filled up by detritus. The basaltic regions, on the contrary, are intersected by numerous fiords, and contain many good harbors, often lying behind narrow tongues of land, which probably are old glacier moraines.

There are many lakes, but most of them are small. In the valleys of the basaltic tracts are deep lakes hollowed out of the solid rocks, as, for instance, the Lagarfljot, the surface of which lies 85 feet above sea-level, while its bottom is 275 feet below. In the highlands one finds several groups of moraine lakes, and in recent times large sheets of water have been formed by the damming up of glacier streams. Certain lakes fill hollows formed by the sinking of lava streams, while others are typical crater lakes. During a journey in 1889 Herr Thoroddsen discovered to the west of the great snow-field of Vatnajökull, a grand and beautiful group of crater lakes. This country is remarkable for its natural beauty; the whole surface is covered with colossal craters filled with water, and would resemble a landscape in the moon were it not for the greenish pools that show themselves everywhere among the coal-black lava, the brownish mounds of ashes, and the red heaps of scoriæ.

The glaciers of Iceland cover an area of 5200 square miles. The climate is peculiarly suited for the development of large glaciers, for the air is keen, cold, and damp. On the southeast coast the rainfall is considerable, and here lies the great Vatnajökull, 3100 square miles in area. The humidity on the coast is much greater than it is in the interior highlands, as is shown by the height of the snow-line. On the south side of Vatnajökull the snow-line descends to 1970 feet, while on the north side it is 4270 feet above the sea. The Breidamerkurjökull glacier advances on the south to 65 feet above the sea, while the lowest glacier on the north terminates at an altitude of 2500. Large areas (4300 to 4600 square miles) in the very centre of the island are covered with lava of recent origin. The higher lava-fields are almost entirely devoid of vegetation, and present a most dreary appearance. The most extensive lava desert is the Odadahraun, to the north of Vatnajökull, which covers an area of over 1540 square miles, and lies 2000 to 4000 feet above the sea. Its volume is probably more than 51 cubic miles, and it has been formed by the ejectamenta of 20 volcanoes. There are about 100 volcanoes, of which 20 have been in eruption in modern times. The best-known volcanoes are Hecla, Katla, and Askja. The crater of Askja is 16 square miles in area, and is covered with glaciers which melt in times of eruption, causing great inundations. There are many hot springs, and the geysers are famous for their intermittent eruptions of scalding water. About 75 severe earthquakes have occurred in the past century, many of which have done great damage to life and property. Several shocks in the closing years of the nineteenth century were severely felt in Reykjavik, the capital and chief town.

The climate is not very severe, considering the high latitude, as the island is open to the ameliorating influences of the Atlantic. In the highlands of the interior it is more severe and variable; here snow-storms often occur even in the middle of summer. The winter is long and damp, the summer short and cool. A journey can seldom be commenced before July, for in spring the soil is saturated with snow-water, and the mountains and elevated plateaus covered with snow. Grass first appears on elevated spots in July, while in the highlands of the interior the scattered patches of verdure seldom yield fodder for horses before the end of August. The greatest hindrance to exploration is this scarcity of grass. The lowlands and the valleys have a great depth of rich soil, and on the field slopes grasses of several kinds mingle with the scrubby mountain birch and stunted willow, and afford luxuriant herbage for the sheep. A few mountain ashes are the only trees worthy of the name, *Elymus arenarius*, a species of wild corn, is grown along the sandy coasts; and Iceland moss is a lucrative article of commerce.

The fauna embraces, in seven families, 34 species of mammals, 24 of which live in the water. Seals breed around the coasts, several varieties of whales, basking sharks, and over 60 species of fishes abound in the adjacent waters, and walruses are sometimes caught. White and blue foxes are numerous and are hunted for their fur. In 1770 reindeer were imported from Denmark, and are now found wild in the interior. Polar bears frequently arrive on ice-drifts from Greenland. The horse, the cow, the sheep, dog, and cat are the domestic animals. The dog resembles the Scotch collie and the Eskimo dog. Among indigenous birds are the falcon, ptarmigan, whistling swan, and several species of ducks. The eider-duck is especially valuable for its down, and is jealously protected.

Agriculture and Other Industries. About five-sixths of the inhabitants live by horse, cattle, and sheep raising. A large part of the slopes and river valleys of the plateaus affords excellent pasture for sheep, and in the low-lying lands are extensive meadows, which, properly managed, could support twice the number of cattle that now graze on them. The island contains about 1,000,000 sheep and 20,000 cows. A great deal has been done latterly to improve the soil. Agricultural societies have been formed, and there are now four agricultural schools. At one time a little barley was grown, but it could not be made to pay, and therefore field cultivation has been abandoned. Horticulture, on the other hand, makes great progress, potatoes, cabbages, and rhubarb thrive well, and some berries, such as currants, are cultivated. Woods have never existed since the glacial period, and the brushwood of birch is less extensive than formerly, owing to the sheep. The birch is seldom higher than a man, though in one place on the east side some specimens attain a height of over thirty feet. The mountain ash reaches the same height. The fishing grounds (cod, herring, flounders, whale, and seal) are frequented by English and French boats. The sea is very stormy, and therefore fishing is best pursued in large and strong vessels. The fishermen of Iceland have had to content themselves with small open boats. They brave the billows of the ocean in winter with the greatest boldness and contempt of danger, and every year many lose their lives. Want of capital has prevented them from acquiring large vessels, but considerable progress has been made in this direction, and the Icelanders now possess a fair fleet of fishing smacks. Manufacturing industries, with the exception of fish oil, are utterly absent. The simpler articles of dress and necessaries of life are usually supplied by every native for himself, and the number of artisans is very small. The mineral deposits are not sufficiently large to repay exploitation. Turf is the chief fuel, but some coal is imported.

The chief exports are dried fish, wool, live sheep and horses, eider-down, salted meat, oil, and whalebone. The annual value of the exports amounts at present to over $2,000,000. The imports consist of textiles, cereals, and other foodstuffs, and have an annual value of between $2,000,000 and $2,500,000. Up to 1854 the trade of Iceland was a State monopoly of Denmark. Since then it has been free, and is now chiefly in the hands of Denmark and Great Britain. Iceland has regular steam communication every three weeks with Denmark via Leith, the port of Edinburgh. There are a number of trading stations on the island, and six commercial centres. There are few roads. In the settled districts the traveler follows bridle-paths worn by the hoofs of the small Iceland horses. But a few good roads have now been built, and some of the streams are being bridged. The people are sturdy, and have not allowed the hardships they have endured to crush them. As the farthest outpost of civilization they have always had to fight a hard battle with nature. They are of an earnest, quiet, and somewhat melancholy disposition, and as a rule very intelligent. Though the lower classes live in poor circumstances, they are very enlightened; perhaps in no other country of Europe are so many books, in proportion to the population, printed and sold as in Iceland. The island contains five printing establishments, from which issue ten newspapers and eight periodicals. During recent decades many Icelanders have emigrated to America, and have founded flourishing colonies in Manitoba. In all about 12,000 have crossed the Atlantic, but of late years the emigration has fallen off. Besides Reykjavik, the capital, with a population of about 4000, the chief settlements are Akreyri and Isafiord.

Government. At the head of the administration is a Governor-General, appointed by the King of Denmark, and exercising his authority under the supervision of the Secretary for Iceland at Copenhagen. The Althing, or the Parliament of the colony, although in existence since the Norwegian occupation, had not attained its full power before 1874, when the new Constitution granted by the King of Denmark endowed it with complete legislative authority. The Althing consists of 36 members, of whom 30 are elected by the people, and 6 appointed by the Crown. It is convened every two years, and is divided into two chambers, of which the upper is composed of six elected, and as many appointed members, and the lower one consists of 24 elected members. For purposes of administration the island is divided into three districts—the South, the West, and the North and East—administered by two officials having their seats at Reykjavik and Akreyri. The districts are subdivided into 20 smaller divisions known as syssels, and administered by sheriffs, who perform the functions of tax collectors, and judges of first instance. At Reykjavik there is a court of second instance from which appeals are made to the Supreme Court at Copenhagen. The revenue is derived from customs and tax on spirits, tobacco, coffee, and sugar. Elementary education is well provided for, and the number of illiterates is remarkably small. There are also a number of higher schools, a theological seminary, and a college at Reykjavik, with about 100 students. For religious purposes Iceland forms a separate bishopric in the Lutheran Church.

POPULATION. The population, estimated at over 46,000 at the beginning of the nineteenth century, was 72,422 in 1880; 70,927 in 1890. The birth-rate is large, but it is offset by the large infant mortality resulting from the severity of the climate. The Icelanders are of Scandinavian origin, and belong exclusively to the Lutheran Church. They live mostly on isolated farms, there being very few settlements.

HISTORY. Iceland was not visited by Europeans, as far as is known, until the end of the eighth century, when some Celts landed on the island, but its history really dates from about 870, when various Norsemen discovered it, chiefly by accident. One of these, Flóki Vilgertharson, gave it its present name. Soon thereafter the Scandinavians came in large numbers, owing to the despotism of Harold Haarfagr (q.v.) at home, and permanent settlements were made, among them the present capital, Reykjavik. The settlements were all independent of one another, and for some time the only bond of union was furnished by their common religion, until finally in 927 one Ulfljotr was sent to Norway to prepare a code of laws. He did so, returning in 930. His Constitution provided for a yearly assembly, but all details are lacking to us. Many legal changes, however, had to take place before even a semblance of order prevailed in Iceland. In time, regular territorial divisions appeared, and a system of law very similar to that of Anglo-Saxon England. The most important event in the early history of Iceland was the conversion of its inhabitants to Christianity. The first missionary was Thorvaldr Kothranson, who came in 981, but after five years left the country, having failed utterly. More successful was the attempt made under the auspices of King Olaf Tryggvason of Norway (995-1000), who introduced Christianity, chiefly by force, in the year 1000. Under the influence of the new religion civilization gradually spread, and the laws became milder. Until 1103 Iceland belonged to the province of the Archbishop of Bremen, later to that of Lund. Meanwhile the kings of Norway regarded Iceland with a jealous eye, for it was a place of refuge for all their rebellious subjects, but all attempts to conquer it failed for many years. The history of the island was mainly one of rivalries of different chiefs, and about the beginning of the twelfth century all the contests in the land were connected with those of the three sons of Sturle, the historian Snorri, Thord, and Sieghvat, the most powerful chiefs of their time. By marriage and other means, Sturle Thordson had become *godar*, or supreme magistrate, of several provinces, for these offices were hereditary in certain families. These offices he transmitted to his sons, who, however, were unable to agree. Finally, in 1262, Norway having been appealed to, King Hakon of that country induced Iceland to join its fortunes to that of Norway. The prosperity of the country from that time onward rapidly declined as strict navigation laws were enforced. In 1380 Iceland, joined together with Norway, came under the Crown of Denmark. Much of the subsequent history of the island is filled with the relation of physical evils which desolated the land, and effectually subdued the spirit of its inhabitants. Thus there were repeatedly severe volcanic eruptions, and between 1402 and 1404 the black death depopulated the island, sweeping away, it is said, two-thirds of the population. In 1540 Christian III. of Denmark began to introduce into Iceland the Reformation, which rapidly prevailed throughout the whole country. Its history since that time has been on the whole scarce in striking events. During the Napoleonic wars England captured it, but gave it back to Denmark by the Treaty of Vienna in 1815. The Althing or Legislative Assembly, which had existed since the earliest times, was now dissolved, but was reorganized in 1843. For many years constitutional conflicts with Denmark went on, which were finally amicably settled in 1874. Since then Iceland has had practically home rule.

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ICELANDIC LANGUAGE. With the Norwegian popular dialects and Faroese, Icelandic forms the West Norse subdivision of the Scandinavian languages, as opposed to the East Norse, made up of Swedish and Danish. The history of Icelandic begins with the settlement of Iceland by Norwegians, principally from Western Norway, at the end of the ninth century. After this time there was gradually developed in Iceland a particular West Norwegian dialect, which, however, at the outset differed but slightly from the parent Norwegian. Only after the introduction of Christianity, about the year 1000, is it possible to speak of languages instead of dialects in the whole Scandinavian north, and at this time Icelandic, too, ranged itself by the side of Norwegian, Swedish, and Danish as a separate language, with characteristic differences in sounds, inflection, and vocabulary.

In the history of Icelandic it is customary to distinguish two main periods—Old Icelandic, from the settlement of the island, in the ninth century, to the Reformation, at the middle of the sixteenth century, and New Icelandic, down to the present day. Old Icelandic is further subdivided into three periods, the first of which extends from 874 until about 1200; the second, the so-called classical period, during which the principal literary works were produced, from 1200 to about 1350; and the third, or transitional period, from 1350 to 1540. The language of the first period, at the beginning identical with that of Norway, at the end is distinguishable from it by but comparatively few differences. One of the most plainly discernible and characteristic distinctions between the two is the retention in Icelandic of initial *hl, hm, hr*, whose *h* early disappears in Norwegian, as it does in Swedish and Danish, but which has remained in Icelandic, alone of all the Germanic languages, to this very day. The language of the second period, on the other hand, exhibits many important changes along broad lines, in phonetic conditions and in inflectional forms, that from this time on sharply differentiate Icelandic and Norwegian. This forms an intermediary period which witnesses the gradual growth of those changes in the language whose consummation marks the beginning of the new period of Icelandic. During this whole time the language remained practically homogeneous throughout the island, and no sharply defined dialectic differences were developed. Manuscripts of the thirteenth and fourteenth centuries from the west of Iceland show, it is true, characteristic phonetic conditions in certain instances, and it is likely that others existed as between the north, west, and southeast, but none of them are important. From 983 to about 1400 Icelandic was also spoken in the settlements of Greenland, but to what extent this language deviated from that of Iceland cannot be determined from the few runic inscriptions which have come down to us.

Old Icelandic, both from the standpoint of the language itself and of the literature written in it, is by far the most important of the ancient Scandinavian languages. The sources of our knowledge of it are an almost unparalleled literature in prose and verse, written after the early part of the twelfth century, but often of far more ancient ultimate origin. The alphabet used is the usual Latin script of the end of the Middle Ages, introduced by way of England and modified to fit the special conditions of the language. The few runic inscriptions that exist in Iceland are unimportant from a linguistic point of view, in that they are all more recent than the oldest manuscripts written in Latin letters. The oldest conditions, however, are in many cases not to be found in the oldest manuscripts, but in poems contained in manuscripts of the thirteenth century, which, as a consequence of their metrical construction, have kept forms as old, in some instances, as the ninth century, from which early time they had been transmitted orally from generation to generation. The oldest manuscript that has been preserved is an inventory of the church at Reykjaholt, in Iceland, the most ancient part of which was probably written between 1178 and 1193. The principal manuscript of the Elder Edda, the so-called Codex Regius, dates from the end of the thirteenth century; the principal manuscript of the Snorri Edda, the so-called Codex Upsaliensis, is of the same period. The best manuscripts are all written before the middle of the fourteenth century. Icelandic manuscripts are both parchment and paper. The former medium was used from the beginning of writing, at the end of the twelfth century, down into the sixteenth century; the latter from the fifteenth century almost to the present day. Old Icelandic manuscripts are preserved principally in four large collections—viz. the Arnamagnæan collection, so called from the Icelander Arni Magnusson, who collected and gave it to the University Library in Copenhagen; the collection in the Royal Library in Copenhagen; the so-called Delagardic collection, in the University Library in Upsala, Sweden; and the collection in the Royal Library in Stockholm. Besides these, there are a few manuscripts in the University Library in Christiania, Norway; in the British Museum, in London; the Bodleian Library, in Oxford; the Advocates' Library, in Edinburgh; in Germany, in Wolfenbüttel, in Tübingen; in Utrecht, Holland; in Vienna and Paris. No manuscripts of importance whatever have been left in Iceland, with the exception of the Reykjaholt inventory, which is a single quarto leaf of parchment preserved in the public archives in Reykjavik.

The most predominant characteristics of Old Icelandic as a Scandinavian language are, in the main, the following: To an extent unknown to the other members of the Germanic group, Icelandic exhibits a consistent and widely developed process of assimilation in consonants and vowels; under this head falls the extraordinary extension of umlaut, which is here not merely a process of palatalization, as elsewhere in the Germanic languages, but of labialization as well. There is besides this a characteristic preference for suffixes, as exhibited in the use of the suffixed definite article with substantives, masc. *-nn*, fem. *-n*, neut. *-t;* the formation of an entirely new medio-passive conjugation by the suffixal use of the reflexive pronoun; and the expression of negation by an added *-gi*, *-a*, or *-at*. Other important characteristics are the universal shortening of the vowels of inflection and of derivation; the disappearance of final *n* in the so-called weak inflection of substantives and adjectives, and in the infinitive of verbs, whose accompanying preposition, furthermore, is *at*, instead of *du* (*zu*), as in the other Germanic languages, and the use of the consonantal case ending *-r*, elsewhere retained only in Gothic as *-s*, in masculine and feminine substantives. There are, in addition, many other minor peculiarities in sounds, inflections, and syntax. Contrasted with Old Swedish and Old Danish, whose earliest documentary remains date from 1281 and 1329 respectively, Old Icelandic possesses, as a whole, as is to be expected, a much more ancient character in sounds and in inflectional forms. It is, however, by no means invariably the most conservative. The far greater extension of the process of umlaut, for instance, in Old Icelandic, results in a large number of forms that are more recent than the corresponding ones in the other Scandinavian languages in their oldest period. The notably wide vocabulary of Old Icelandic shows some admixture of foreign elements. These are Latin words, introduced mainly through the Church after the Christianization of Iceland in the year 1000; Celtic words, introduced in considerable number as a result of the contact of Celtic-speaking people in the British Islands with the Norwegian settlers of Iceland, many of whom came by the way of Scotland, Ireland, the Orkneys, the Hebrides, and the Shetlands, where they had previously lived for longer or shorter periods; Anglo-Saxon words, which came in as a consequence of the close contact of Icelanders in England with the people, their language, and their culture; and finally, a few French and German words, due to the use in literature of foreign material, derived either directly or remotely from these sources.

The history of New Icelandic, or the present period of the language, begins with the Reformation, although the conditions that characterize it can already be observed in process of development in the transitional period at the end of Old Icelandic. The earliest literary monument of New Icelandic is the first Icelandic printed book, the New Testament, translated by Odd Gottskalksson, and printed at Roeskilde, in Denmark, in 1540. In general, Icelandic has still retained, to the present time, along broad lines, in inflections and vocabulary, its archaic characteristics, so that to-day it is on the whole the most ancient in appearance of the Germanic tongues. Since the beginning of the period the language has, however, in reality undergone a continual internal development. This is particularly true of the sounds, which have been very materially changed in pronunciation, although frequently the conservative retention of the old orthography gives no clue to it. What has helped Icelandic to retain its early conditions is, more than anything else, its relative isolation and the consequent minimum contact with other languages, on the one side, and the fact of its unbroken use in literature on the other. The production of literature in Iceland, although it dwindles in value and amount after the classical period until it is awakened to new life by the Reformation, has never wholly ceased since its very beginning. All this, with the continuous culture of the old literature, which has in some form or other never been forgotten, has tended to keep the language phenomenally pure and homogeneous throughout the island. After 1380, when Iceland, which since the end of the Republic in 1262 had belonged to Norway, fell with that country under the sovereignty of Denmark, a Danish influence was exerted upon the language which has continued, with varying effect, down to the present time. This influence was particularly active in the two centuries immediately following the Reformation, when, as a consequence of the reawakened literary activity, which brought with it many translations of foreign, and especially of Danish books, it made itself felt in vocabulary and orthography to such an extent that the language seemed on the way to lose forever its characteristic purity. It was an appeal to the old literature which furnished the missing norm, and not only checked the further introduction of Danicisms, but set on foot a reactionary tendency toward the forms and orthography of the classical period of the language. This puristic movement began toward the end of the eighteenth century, but was particularly furthered by the formation of the Icelandic Literary Society by the Danish philologist Rask in 1816. Since that time an influence has been carefully and intelligently exerted, both to eliminate foreign elements from the vocabulary, and either to rehabilitate old forms or to set in their place new forms made out of the old elements of the language, and to reform the orthography from the standpoint of etymology. A printed page of Icelandic at the present day has as a consequence a much more primitive character than the facts of its pronunciation actually warrant. In comparison with the other Germanic languages, changes have, nevertheless, been relatively few, and Icelandic, not only apparently, but in reality, as it is in use to-day, is inherently the best preserved of this entire group.

The present territory of Icelandic, aside from small settlements in the United States and in British America, is the island of Iceland, where it is the spoken and written language of the 70,000 inhabitants. The literary language of the present time is to all intents and purposes the spoken speech, not of any particular region or of any separate class, but of the people of the whole country, with the reservation that in the capital and the trading places along the coast much Danish is in use, and the spoken language is no longer as pure as elsewhere. As in the old period, there are no dialects in modern Icelandic, although there are still, as then, minor differences that give the language of certain parts of the country a local color.

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its references, but marred by careless etymologies. For the poetical language the standard work is still Sveinbjörn Egilsson's *Lexicon Poeticum Antiquæ Linguæ Septentrionalis* (Copenhagen, 1860). The best recent dictionary is Fritzner's *Ordbog over det gamle norske Sprog* (2d ed., Christiania, 1883-96), with renderings in Danish. Larsson's *Ordförradet i de älsta islanska handskrifterna* (Lund, 1891) contains an exact reference to each occurrence of every word in the oldest Icelandic manuscripts. Gering's *Glossar zu den Liedern der Edda* (2d ed., Paderborn, 1896), and Möbius's *Altnordisches Glossar* (Leipzig, 1866) are valuable special dictionaries. Thorkelsson's *Supplement til islandske Ordböger* (Reykjavik, 1876-85) contains words not found in previous dictionaries, including Icelandic through the seventeenth century.

ICELANDIC LITERATURE. In order to understand the remarkable brilliancy of the classical Icelandic literature of the twelfth and thirteenth centuries, it is necessary to bear in mind the fact that the early settlers were among the cream of the Norwegian people. In spite of the political difficulties that had induced these hardy Norsemen to seek a home almost in the ocean itself, intercourse between Iceland and the Scandinavian Peninsula continued to be very close, especially as a result of the frequent visits made to Norway by young Icelanders of rank. Another reason for the literary supremacy of the early Icelanders is closely connected with one of the principal natural drawbacks of the island, its severe climate, and the consequent isolation of the people during the greater part of the year. Persons in Iceland were thus greatly thrown upon their own resources. As a result, the art of story-telling was resorted to for passing away the monotony of the dark winter days. The periodical meetings in summer were used for an interchange of news and of stories and poems, and to this day the Icelanders are probably the greatest lovers of oral literature. The Icelandic classics still form the most popular reading matter of the masses of the people. This vitality of the Icelandic literature is again closely connected with social conditions. The Icelanders are a homogeneous people, and in reading the accounts of the early heroes of Iceland they read the stories of their own ancestors, whose names have been familiar to them from early childhood. For them the long genealogies, which the most patient foreign reader finds tiresome, are full of interest as family records of the remote past, and the most insignificant detail is fraught with the vividness of personal association.

Turning to the literature itself, we find, as is the case with the other literatures of the world, that the earliest monuments are in verse form. The earliest monument of Icelandic literature, furthermore, the so-called *Older Edda*, is, like our own Beowulf, the most important and interesting work produced, and claims, more than any other single work, the attention of Icelandic scholars. The *Older Edda* is not a poem, in the strict sense of the word, but a collection of more or less closely connected poems of varying length and character, which were preserved for a long time by oral tradition, suffering inevitable changes in the process of transmission. For many centuries the manuscript containing the poems was forgotten, and on its discovery in 1643 it was attributed to the classical writer Sæmund, called the Wise, who lived in the last half of the eleventh and the first half of the twelfth century. It has since been proved conclusively that it was redacted by an unknown Icelander. A curious error is also frequently repeated with regard to the etymology of the word Edda itself, which is explained as meaning great-grandmother. As a matter of fact the name was improperly extended from a prose work, the so-called *Younger Edda*, the work of Snorri Sturluson (q.v.). The age of the *Older Edda* has been greatly exaggerated, the oldest portions probably belonging in their present form to the tenth century. (For an account of the poems, see EDDA.) *The Younger*, or *Prose Edda*, is of great value, because of the information it gives of Icelandic mythology and the language of the early skalds. It is a sort of *ars poetica*, and was compiled for the guidance of young poets. Its style is admirable, its tales of the gods and goddesses being related with a due attention to effect. The style of most of the early Icelandic poetry is in marked contrast to the simplicity and directness of the classical prose. The most complicated figures and the most obscure references are freely used. The form is alliteration combined with assonance, or the agreement of medial vowels. Most of the poems of the skalds are short, eight verses each, but some few longer poems occur. The most striking of the latter are the three poems by Egil Skallagrimsson, the hero of the Egils Saga. They are much simpler than the short poems by the same author, and are full of feeling and dignity. Egil's elegy on his son may be ranked among the great poems of the world. To the eleventh and twelfth centuries belong poems composed in imitation of the ancient works, consisting of moral and didactic maxims, the former conceived from an assumed heathen, the latter from a Christian point of view. In the thirteenth century the skaldic art declined and gave place to an inferior literature based upon biblical stories and legends of the saints. Two centuries later appeared the *ríma*, or ballad, which closely resembles in form and subject matter the ballad as found on the Continent. These continued in popularity until the seventeenth century. Frequently the classical sagas were paraphrased in these *rímas*.

The earliest Icelandic prose belongs to the beginning of the twelfth century, when Ari the Wise (1067-1148) composed a history of his native island and its population in the *Islendinga-bók* (The Book of the Icelanders), which is a revision of an earlier work by Ari. The value of this work is historical rather than literary, for its facts, while detailed and reliable, are not presented in an interesting style. It has been edited, with a German introduction and notes (Halle, 1891). The *Landnáma-bók* (Landtaking Book), also by Ari, is based upon the earlier *Islendinga-bók*. It describes the discovery and settlement of Iceland, and contains detailed accounts of 3000 persons and 1700 places. It was continued by others. There is an English translation by T. Ellwood (London, 1898). These works entered largely into the composition of the annals of the early kings of Norway, composed a century later by Snorri Sturluson (q.v.), under the title of the *Heimskringla* (Circuit of the World), the opening word of the work. This work deserves special notice as being the most important historical contribution of the Middle Ages.

It is characterized by a vivid style, and so strongly does it appeal to the Icelandic consciousness that it is still the most popular book after the Bible in Iceland. A new translation into Dano-Norwegian has been made (1900) by G. Storm, and published with a subvention by the Norwegian Parliament. The best edition in the original is that edited by F. Jónsson (1893-1901). A continuation of the *Heimskringla* was composed by several authors. It has twice been translated into English, by David Laing (London, 1844 and 1889), and by W. Morris and E. Magnússon (London, 1895). Other histories belonging to a later period are *Flateyarbók*, containing a rather confused selection of sagas, the *Fœreyingasaga*, which tells of the introduction of Christianity into the Faroe Islands (translated by F. York Powell, 1896), and the *Orkneyingasaga*, relating the history of the earls of the Orkneys. The parts of the *Flateyarbók* relating to the discovery of America have been edited by A. M. Reeves in *The Finding of Wineland the Good* (London, 1890). The compilation of the laws of the island attracted the attention of the Icelanders at an early period, and in 1118 a complete code, known as the *Grágás* (gray goose), which had been derived from the ancient Norse law, was submitted to the *Althing*, or popular assembly, and in 1123 the canons of the Church, or the *Kristinrettr*, were settled and reduced to writing. A collection of these enactments in the ancient and subsequent codes has been made by Stephensen and Sigurdsson (Copenhagen, 1853), under the title of *Lagasafn handa Islandiæ.*

Of hardly inferior interest to the *Edda* and the *Heimskringla* are the sagas (q.v.). This term in its broadest sense includes all Icelandic prose works of a narrative character. Thus, strictly speaking, Ari's works cited above are sagas, as is also the *Heimskringla*. But as generally used the term saga is applied to shorter narratives, the interest of which centres in one person. The scene of the saga may be laid either wholly or in part in Iceland, or occasionally altogether outside of Iceland. Sagas are divided into several classes, the first of which is the mythic-heroic. The representatives of this class often give a later version of some well-known story which appears in other literatures. This is notably the case with the most interesting representative, the *Völsunga Saga*, earlier traces of which appear in the Eddas, and a later version in the *Nibelungenlied* (q.v.). It has been translated by W. Morris and E. Magnússon (London, 1870). The *Vilkina Saga*, treating of Dietrich of Bern, is later, and shows German influence. The *Fridthiofs Saga* is of special interest as being the earliest version of the story made famous by the Swedish poet Tegnér (q.v.). A number of legendary stories were translated into Icelandic prose, the most important of which is the *Saga of Barlaam and Josaphat* (q.v.). The second and most characteristic class of sagas are the family sagas, accounts of individual men and their families. These biographies, as they would now be called, deal with the earliest settlers of the island, and extend to about 1050. They are marked by great simplicity of style, with frequent highly dramatic passages, extreme detail, especially in connection with genealogies and chronologies, and keen characterization. A striking feature of all the sagas is the introduction of verses supposed to be the work of the characters. This is particularly noticeable in the *Kormaks Saga*, which contains an average of over one poem to each page. The family sagas are subdivided into two classes, the larger sagas and the smaller sagas. To the first belong the *Njáls*, the *Egils*, the *Laxdœla*, and the *Eyrbyggja*. Of these, the first has been admirably translated by G. Webbe Dasent (2 vols., Edinburgh, 1861), and the last was translated in a condensed form by Sir Walter Scott. The *Egils Saga* has been edited with a German introduction and notes by Finnur Jónsson (Halle, 1894), and in the same series the *Laxdœla Saga* has appeared, edited by Kr. Kaalund (1896). Among the smaller sagas, the most interesting are the *Kormaks Saga* and the *Saga of Gunnlaug Serpent Tongue*, both of which are love tales. Apart from their literary qualities, the Icelandic sagas are of great value in throwing light upon many Old Norse customs—religious, legal, and social—that would otherwise be entirely unknown. This is especially true of the *Eyrbyggja*. For the English reader, the introduction to Dasent's translation of the *Egils Saga* is of interest in connection with the general subject of sagas.

Modern Icelandic literature begins with the introduction of printing (1530) by the last Roman Catholic Bishop of Iceland. The first Icelandic translation of the New Testament was made in 1540. During the seventeenth century many learned works were written, the leader in this movement being Arngrim Jónsson (1568-1648). Many manuscripts were collected and copied, and communication between Icelandic and Danish and Swedish scholars was close. Grammars and dictionaries were compiled, and many antiquarian works were published. Among the principal scholars of this period were Thormod Torfæus (1636-1719) and Arni Magnússon (q.v.). During this same period, and without interruption down to the present day, Iceland has produced a surprisingly large number of poets—the largest number, indeed, in proportion to the population, of any country in Europe. Among these poets may be mentioned Hallgrimur Pjetursson (1614-74), the leading Icelandic psalm-writer; Stefan Olafsson (1620-88); Eggert Olafsson (1726-67); and Jon Thorlaksson (1744-1819). The latter made an excellent translation of *Paradise Lost* and Klopstock's *Messias*. Among nineteenth-century poets may be noted Bjárna Thórarenson (1786-1841), who is probably the most popular recent Icelandic poet; Jónas Hallgrimsson (1807-45), who introduced several foreign verse forms, notably the hexameter. Of the younger poets we may mention Gestur Pálsson (1852-91); Matthias Jochumsson (1835—), one of the most productive Icelandic poets and author of one of the few successful dramas; Thorsteinn Erlingsson (1858—); and Hannes Hafsteinn (1861—). The principal Icelandic novels are Jón Thordarson's *Piltur ok Stulka* (The Boy and the Girl) and *Mathur ok Kona* (Man and Wife).

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Prolegomena to Vigfússon's edition of the *Sturlunga Saga* (Oxford, 1878) discusses the classical literature, and the same author's *Corpus Poeticum Boreale* (ib., 1883) contains a complete collection of the poetry down to the thirteenth century, with English translations, notes, etc. The value of this work is impaired by the arbitrary arrangement of many of the poems, especially those of the *Older Edda*. Extracts from the literature will be found in Vigfusson and Powell, *Icelandic Prose Reader* (London, 1868), and in other similar works. Consult also the introductions to the translations of individual sagas in the *Saga Library*, edited by Morris and Magnússon (London, 1884).

ICELAND MOSS (*Cetraria Islandica*). A lichen found in cold climates, especially in Iceland and Norway, in which places it forms an important article of commerce. It is also met with on the higher mountains to the south, but is neglected. It is used largely as a food by the Icelanders and the Laplanders, who either powder the dried plant and make it into bread, or boil it with milk. As food also it has been used in other countries to which it is exported. Before it becomes edible, however, it must be steeped in water to remove a bitter principle. Other uses are in the manufacture of sizing-paper and in dressing the warp in weaving. Formerly it was used as a remedy in pulmonary troubles, but is now regarded as a bland mucilaginous diet in such cases.

ICELAND SPAR. A transparent variety of calcite that is found chiefly in Iceland. Owing to its transparency and double refracting property, it is used for polarizing prisms and in other optical instruments. See Calcite.

ICE-NEEDLES. See Frost.

ICE′NI. A tribe of ancient Britain, occupying, as is supposed, the present counties of Norfolk and Suffolk. The Iceni joined the ranks of Aulus Plautius in A.D. 43, and secured the defeat of the sons of Cymbeline (q.v.). Some years later (A.D. 61), when the Romans endeavored to establish their authority more firmly in the country, the Iceni rebelled under their Queen, Boadicea, but were subdued. See Boadicea.

ICE-PACK. See Ice.

ICE-PETREL. A brown and white petrel (*Puffinus gelidus*) of the Antarctic seas.

ICE-PLANT (*Mesembryanthemum crystallinum*). A tender greenhouse annual herb, native of Africa and of the south of Europe, remarkable for the glistening bladder-shaped hairs with which its whole surface is covered, and which sparkle in the sun like granules of ice. The seeds are used for food in the Madeira Islands. The ashes supply barilla, which is extensively used as a source of carbonate of soda in soap and glass making, and for which the plant is burned in countries where it abounds. There are in all about four hundred species of this genus, most of which are natives of the south of Africa. The ice-plant is introduced and spreading in southern California. *Mesembryanthemum æquilaterale*, a trailing plant, is also common in California, where its purple flowers, one and a half inches across, are very striking. *Mesembryanthemum edule* bears edible fruits called Hottentot figs.

ICE POLO. A game on skates, which should not be confounded with ice hockey, nor with the equestrian game of polo, though it is related to both these games. Whether ice polo is derived directly from them is uncertain, and of little consequence. It is sufficient to point out the main differences in these two games. The words hockey and polo have been loosely applied to a number of games, but there should be little difficulty in placing them properly. While ice polo is similar in object to ice hockey, it is very different in methods of play. A ball is used instead of a puck, the construction of the stick and the method of handling it are different, and there is a more open manner of play. This open play is brought about through the permission to indulge, in an ice-polo game, in what would in ice hockey be off-side play, that is, getting between the ball and the opponents' goal. Five men make up a team, two less than in ice hockey. There are two rushers, one centre, one halfback, and one goal-tend. The goals are four feet wide and the distance from goal to goal is 150 feet. There are two playing periods of twenty minutes each, with ten minutes' interval. A goal counts three points. The game never had much vogue outside of New England. See Hockey.

ICE-PLANT.

ICE YACHTING. Excepting Russia, no country in the world shares with America the sport of ice yachting, and Russia is only a sharer in the sense that a few of its boats, such as those of 'the Russian River Club,' are sailed over a portion of the Gulf of Finland, near Saint Petersburg. As early as the year 1790 there were ice boats, and contests at Poughkeepsie on the Hudson, the runners of one of the boats being still preserved. It was built by Oliver Booth, and was little more than a square box on three runner skates: one on each side of the box, and the rudder one set in an oak post with an oar-tiller. It was sailed with a small flat-headed spritsail. More than half a century passed before there was much improvement in this primitive design. The first real innovation was that of Allaire of Red Bank, N. J., on the Shrewsbury River, who in 1856 mounted his three runners on a triangular frame, a pattern that was at once seen to give advantage over the previous method. From this the Hudson River boats were gradually developed, the side bars forming with the body a bridge or runner plank (at right angles with the body of the yacht) projecting on each side, and carrying at each end one runner or skate. The mast was stepped at the junction of the runner plank with the main beam; and they had low sails with large jibs, short non-peaked gaffs, and booms extending many feet out from the stern. This style reached its limit in 1869 in the old *Icicle.* The stepping of the mast over the runner plank placed the centre of effort so far aft that the boats would run away with their occupants, and throw them out, sometimes to their great peril. In 1879 this class was practically superseded by the *Robert Scott* type of a single backbone, with an elliptical steering-box. Then the mast was stepped forward of the intersecting runner-plank, and the jibs and boom shortened. Improvements have continued, but mainly in construction, which has aimed at strength combined with lightness in backbone and masts, and springiness in the cross or runner plank: a very desirable condition, for if a runner under an ice yacht weighing 2000 pounds, and going at 45 miles an hour, strikes a hummock of ice, and has no give or spring in it, the consequence may be a shock that will reduce the craft to pieces. In the year 1866 the lateen sail was adopted, both on the Hudson and Shrewsbury rivers. *Scud,* with the largest lateen ever rigged, was sent from the Shrewsbury to Poughkeepsie on the Hudson, and entered for the pennant several years. She, as well as *Ariel* and *Blizzard,* were exceedingly fast, but, without apparent reason, they would spin round on their heels like tops, or bolt, and in spite of its admittedly many good qualities, and undoubted speed, the rig lost supporters. Theoretically any sailing craft should do its best with all its canvas in one piece. *Flying Scud* modified the lateen by spreading its 615 feet of sail, or cat-boat fashion, by supplementing it with a small jib, and *Vixen* and *Ranger* had other developments of the lateen. The lateen sail has still some stanch friends. The *Georgie* of the Shrewsbury River fleet, and Colonel Higginson's *Cold Wave,* with the Mohegan cat-rig, are two examples of it.

The latest design in runners is that of H. Percy Ashley, known as the rocker type. These have a curve fore and aft. They are especially useful on rough ice. The elongated tiller, too, is of the utmost importance on occasions, because it allows the sailor to lie head forward in the steering-box and guide the yacht with his feet while yet tending sheet with his hands.

The usual course in races is a triangle of one mile on each leg, of which only one can be before the wind, and five times around the triangle constitutes a heat. This necessitates ten sharp turns. The time made by boats over such a course necessarily varies very much on each leg, and still more from day to day, according to the condition of the ice, and the force and direction of the wind. The fastest time made in the pennant championship over the regulation course was by *Icicle* in 1897 in 46 minutes 19 seconds. Much faster time has been made on a straightaway course in a favorable wind: it is not an uncommon incident under those circumstances for a boat to pick a race alongside the railroad on the Hudson's banks, and outsail an express train.

The principal original locations for ice yachting were the Hudson River above Poughkeepsie, Newburgh, and Orange Lake, N. Y., and the Shrewsbury River in New Jersey. From these the sport spread westward in the sixties to Lake Minnetonka, Minn., where it was introduced by Theodore Wetmore, and much fine sport has been had by yachtsmen from Saint Paul and Minneapolis. Lake Winnebago, Wis., has also a half-dozen clubs on its borders. Lake Pepin, about 40 miles south of Saint Paul, is the centre for the boats of several towns. At Bar Harbor Lake in Maine there is excellent sport, as well as at Burlington, Vt., on Lake Champlain. In Canada ice yachting is very popular, and on Lake Ontario there is much racing of boats from clubs, both in the Canadian and American ports. So there is in the Bay of Quinto, and on the Saint Lawrence River. No favorable conditions are allowed to pass either at Montreal or Quebec, and on many other of the large inland lakes followers of the sport test their skill.

There are many prizes annually competed for; but as ice yachts are by their nature difficult to move from watershed to watershed, they are mostly local.

ICHABOD, ĭk′ȧ-bŏd. A poem by Whittier, intended as a rebuke to Daniel Webster for his change of attitude toward the question of slavery.

I-CHANG, ē′chäng′, **Ē CHANG.** A *fu* or departmental city of the Province of Hu-peh, China, situated on the left bank of the river Yang-tse, about 1100 miles from the sea, and about 15 miles below the entrance to the great Yang-tse Gorges (Map: China, D 5). It stands in the centre of a hilly country rich in rice, cotton, wheat, barley, and wood-oil trees (the *T'ung-shu* or *Aleurites cordata*), and many kinds of fruit grown in the sheltered valleys near by. The climate is dry, with warm summers and pleasant winters.

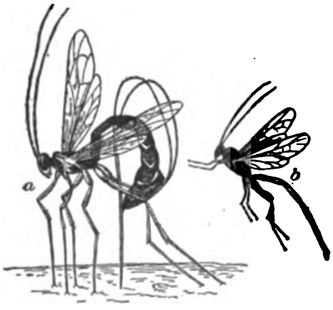
The place is of great commercial importance. It is for the present the limit of up-stream steam navigation, the few attempts that have been made to mount the rapids of the Upper Yang-tse having resulted in disaster. Hence all cargoes destined up-stream are here trans-shipped to craft specially constructed for the navigation of the river above I-Chang, and most of the down-stream cargoes from Sze-chuen are also trans-shipped. The city is one of four opened in 1877 to foreign residence and trade, in accordance with the convention signed at Chi-fu in 1876, and a few foreign business houses have agents here. Great godowns or warehouses have been built to accommodate this transit trade, and a foreign settlement has been laid out just below the native city. In 1900 the total trade of the port amounted to 23,143,617 Haikwan or custom-house taels. The total imports of foreign goods amounted to 10,995,273 taels, and of this goods to the value of 10,479,156 taels were reshipped by native craft to Chung-king in Sze-chuen. The value of the Sze-chuen produce reshipped to ports down-stream was 7,154,970 taels. I-Chang has no direct trade with foreign countries.

The steamer traffic is entirely in the hands of the British and the Chinese. About 15,000 native craft of all sizes (the largest probably about 60 tons) pass this port or call at it, in the course of the year, the river being practically the only way of reaching the great province of Sze-chuen (where the richest coal-fields in the world are situated), and the northern parts of Kwei-chow and Yun-nan. The population of I-Chang is 35,000, including a score or more of foreigners.

ICH DIEN, ĭk dēn (Ger., I serve). The motto of the Prince of Wales, which, surmounted by three ostrich-feathers (originally one), forms his official crest. According to one theory of its derivation Edward I. on presenting his new-born son, Edward of Carnarvon, to the Welsh, who had demanded a native-born prince, used the expression in its Welsh signification—*Eich dyn*, "Behold your man." Another view, not historically verified, attributes it to the occasion of the killing of John, King of Bohemia, by the English at Crécy, and asserts that the Black Prince found the motto under the plume worn by the dead King, and assumed it to imply that 'he served under the King, his father.'

ICHNEUMON, ĭk-nū'mŏn (Lat., from Gk. *ἰχνεύμων*, *ichneumŏn*, tracker, from *ἰχνεύειν*, *ichneuein*, to track, from *ἴχνος*, *ichnos*, track). An old name for the civets of the genus Herpestes, now generally called mungooses. (See MUNGOOSE.) The name belongs specifically to the Egyptian mungoose, or 'Pharaoh's rat' (*Herpestes ichneumon*).

ICHNEUMON-FLY. An insect of a group of parasitic Hymenoptera, forming the family Ichneumonidæ. More than 1100 genera of ichneumon-flies have been described, and many thousands of species. Economically considered they are among the most important groups of insects, since without exception they are parasitic upon or within other insects, and in the very great majority of instances they destroy injurious species. As a rule the ichneumon-fly lays her eggs beneath the skin of the host insect. The egg hatches, and the young footless grub feeds upon the fat and blood and lymph of the host, piercing the fatty tissue with a pair of sharp-pointed jaws. It respects the viscera and vital organs of the host up to the last limit, and only sacrifices them toward the completion of its growth. Its skin is very delicate, and it breathes by absorbing oxygen through this skin from the blood of the host insect, and not, as the older writers supposed, by placing itself in communication with the tracheæ of the host. The digestive tube has a very large stomach which is closed behind, and remains closed until the larva is full grown. When this time is reached, and the larva transforms to pupa, a rectal opening is formed, and the excrement is voided. That such an economy as this is necessary to the life of the parasitic larva is at once seen when we consider that if the excrement were voided daily it would cause speedy inflammation and the death of the host insect before the parasite could become mature. It was formerly supposed that for this same reason the parasitic larva did not cast its skin, but Seurat has recently shown that some of them do occasionally molt.



A LARGE ICHNEUMON-FLY.

Male (*b*) and female (*a*) of *thalessa lunator*, in relative size, the latter in the act of forcing her ovipositor into a log.

Some ichneumon-flies lay their eggs on the skin of the insects they attack, and others near the host insect, so that the parasitic larva, after hatching, finds its way to its prey. When the host insect is an internal feeder, like a wood-borer or a gall-insect, the ichneumon larva lives upon instead of within the host. There is no uniformity in the degree of rapidity with which they develop, and they may pass the winter months either as larvæ, pupæ, or adults. As a rule they are long-bodied, slender insects, varying much in size. Many of them have long, sting-like ovipositors—in some instances, as in Rhyssa, more than twice as long as the body.

Both the scientific and popular names of this group of insects were derived from the Egyptian ichneumon or 'Pharaoh's rat,' which devours the eggs and young of the crocodile.

Consult: Sharp, *Cambridge Natural History*, vol. v. (London, 1895); Comstock, *Manual for the Study of Insects* (Ithaca, 1885); Ashmead, "Classification of the Ichneumon-Flies," in *Proceedings of the United States National Museum* (Washington, 1900). See Colored Plate of INSECTS.

ICHNOLOGY, ĭk-nŏl'ō-jĭ (from Gk. *ἴχνος*, *ichnos*, trace + *-λογία*, *-logia*, account, from *λέγειν*, *legein*, to say). The study of fossil footprints, tracks, trails, and impressions found in the rocks of various geological ages. The most prolific sources of such footprints and impressions in North America are the Jura-Trias sandstones of Massachusetts, Connecticut, and New Jersey. Prof. Edward Hitchcock gathered a great collection of them from the New England localities and placed it in the Amherst College Museum. This collection contains over 8000 tracks, and it furnished the material for Hitchcock's *Ichnology of New England: A Report on the Sandstone of the Connecticut Valley, Especially Its Fossil Footmarks.* Many of the tracks therein described were first supposed to have been made by birds, but they are now known to be the footprints of ornithopod dinosaurs like Anchisaurus (q.v.). Still others were made by heavy five-toed animals of unknown nature. Some of the smaller tracks were made by insect larvæ which are found in the same series of deposits. (See MORMOLUCOIDES.) For an entertaining account of fossil footprints, see the chapter on "Impressions of the Past," in Lucas, *Animals of the Past* (New York, 1901). See FOSSIL; JURASSIC SYSTEM; TRIASSIC SYSTEM.

ICH'THYODOR'ULITES (Neo-Lat. nom. pl., from Gk. *ἰχθύς*, *ichthys*, fish + *δόρυ*, *dory*, spear + *λίθος*, *lithos*, stone). The fossil spines of sharks, which are often found isolated in the ancient rocks. Many of them are of large size, and because of their hardness and phosphatic nature have been preserved with a considerable degree of perfection. Some of them are well known under the names of Ctenacanthus, Macæracanthus, Pleuracanthus, Cyracanthus, etc. Some of these spines have been found in their original positions at the front edges of the fins of fossil sharks. See SHARK.

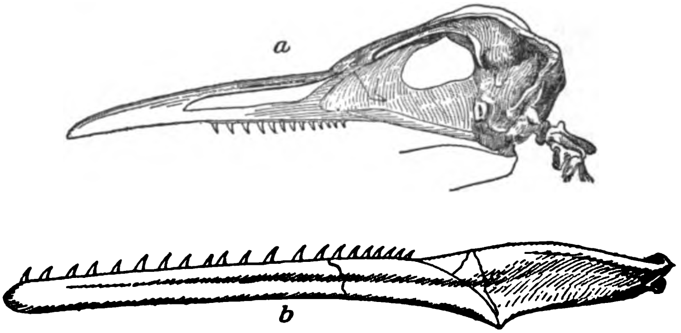
ICHTHYOL, ık'thĭ-ŏl (from Gk. ἰχθύς, *ichthys*, fish), or AMMONIUM ICHTHYOL SULPHONATE. A dark-red oily liquid obtained from a bituminous quartz rich in fossil fish, found in the Tyrol. To prepare the drug, the mineral is distilled with strong sulphuric acid, a saturated aqueous solution of common salt is added to the distillate, and the ichthyol-sulphonic acid which separates out is neutralized with ammonia. The ichthyol thus obtained has a somewhat disagreeable bituminous odor and taste, and is soluble in water, in glycerin, and in various oils. It is an antiseptic, mild irritant, and somewhat of a styptic. It is absorbed with ease by the skin when applied externally, and by the intestinal mucous membrane when administered internally. It is one of the best-known remedies for erysipelas, in which disease it is applied externally in the form of an ointment made up with lanolin. The same preparation is highly recommended for cases of acute articular rheumatism, as affording prompt relief by reducing the pain and the swelling. Unna has declared it to be the remedy par excellence in acne. He applies it externally in the form of a 15 per cent. ointment, and gives it internally in doses of from 2 to 10 grains in pills or in capsules; he also recommends the free use of ichthyol soap. Ichthyol is extensively employed in the treatment of various skin diseases, and is said to be particularly efficacious in eczema, chronic urticaria, and simple sycosis. It is frequently prescribed, with success, as a local application in chronic nasal catarrh, especially in the form known as ulcerative rhinitis.

ICHTHYOLOGY, ĭk'thĭ-ŏl'ȯ-jĭ (Gk. ἰχθύς, *ichthys*, fish + -λογία, *-logia*, account, from λέγειν, *legein*, to say). That branch of natural history which treats of fishes. See FISH.

ICHTHYOPHAGI, ĭk'thĭ-ŏf'ȧ-jĭ (Lat. nom. pl., from Gk. Ἰχθυοφάγος, *Ichthyophagos*, fish-eater, from ἰχθύς, *ichthys*, fish + φαγεῖν, *phagein*, to eat). Among the ancient Greeks, a name for various tribes of coast dwellers on the southern seas; in Asia, on the coast of Southern China, Gedrosia, and Northeastern Arabia; in Africa, on the west coast of the Arabian Gulf and in Senegambia.

ICHTHYOPSIDA, ĭk'thĭ-ŏp'sĭ-dȧ (Neo-Lat., from Gk. ἰχθύς, *ichthys*, fish + ὄψις, *opsis*, appearance). A division of the Vertebrata, including all such forms as have no amnion and alantois, but which have, either persistently or temporarily, gills as their respiratory organs. The group includes the Amphibia (q.v.) and the fish-like forms. This division was introduced by Huxley.

ICHTHYORNIS, ĭk'thĭ-ŏr'nĭs (Neo-Lat., from ἰχθύς, *ichthys*, fish + ὄρνις, *ornis*, bird). A genus of toothed birds of the Cretaceous age, found fossil numerously in western Kansas, along with remains of Hesperornis, Aptornis, and the like. These two genera represent the division Odontotormæ of the toothed birds (see BIRD, FOSSIL), characterized by having the teeth, with which the mandibles were plentifully furnished, set each in a separate alveolar socket. The various species were birds not greater than a pigeon in size, and resembling terns in general appearance and probably in habits. They were sea-birds of powerful flight, and the structure of their wings, legs, and carinate sternum much resembles that of modern birds. The skull, however, retains many reptilian features besides the teeth, such as the diminutive elongated space for the brain, the single-headed quadrate bone, and the union of the lower jaws in front by a ligament. The vertebræ, also, differ from those of Hesperornis and all modern birds, in being biconcave. This form of vertebra is seen in a few recent and many extinct reptiles, but is especially characteristic of fishes; the presence of this character alone would indicate the very antique origin of the group. These birds doubtless lived and fed as do modern gulls, seizing living fishes, and going ashore only to breed and roost at night. They were doubtless well feathered, and seem to have flourished until the end of the Cretaceous era. Most of the fossil remains thus far obtained are in the museums of Yale University and of the University of Kansas. See HESPERORNIS; and consult the authorities there referred to.



SKULL OF ICHTHYORNIS.

a, Cranium and upper mandible of *Ichthyornis regalis*; b, lower mandible of the larger *Ichthyornis victor*.

ICHTHYOSAURUS, ĭk'thĭ-ȯ-sa̤'rŭs (Neo-Lat., from Gk. ἰχθύς, *ichthys*, fish + σαῦρος, *sauros*, lizard). An extinct genus of fish-like reptiles found in the Mesozoic rocks of Europe and North America. The ichthyosaurs among reptiles are analogous to the whales among mammals, and they have many points of resemblance to these. Their bodies were round and tapering, heads large, with long snouts and very short necks, limbs reduced to paddles, and they had a broad, vertical fin on the tail and a triangular fin at the middle of the back. The body was covered with thin, smooth skin and no traces of dermal plates have been discovered. The jaws were armed with a large number of sharp, conical teeth that have a complicated internal structure similar to that of the teeth of Labyrinthodonts or Stegocephalia. The eyes are surrounded by circles of sclerotic bones, and there is a large pineal foramen on top of the skull between the eyes. The vertebræ are biconcave, and the pelvic arch is separated from the vertebral column, for there is no sacrum. In size they ranged from 4 to 40 feet, and they must have swarmed in immense numbers in some portions of the European seas, especially during Liassic time, for their remains have been found in abundance in deposits of that age at Lyme Regis, England, and in Württemberg, Germany. That they were predaceous animals and fed largely on fish, is evidenced by the fish fragments found within their coprolites and also within the abdominal cavity of some skeletons. Some ichthyosaurs were viviparous, for specimens obtained in the Württemberg quarries show several small embryonic skeletons contained in the abdominal cavities of the adults. About thirty-five species of Ichthyosaurus are known, and they have been found in the Mesozoic deposits of Europe, the East Indies, Australia, New Zealand, and South America. Allied genera are Mixosaurus, of small size from the Trias, and Ophthalmosaurus, a toothless ichthyosaur from the Upper Jurassic and Lower Cretaceous. A single representative, Baptanodon, is found in the North American Jurassic, and is very close to Ophthalmosaurus. The ichthyosaurs and their allies, together with the Sauropterygia, comprising the plesiosaurs and allied forms, were formerly included in an order Enaliosauria, which is not now recognized.

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ICHTHYOSIS, ĭk'thĭ-ō'sĭs (Neo-Lat., from Gk. *ἰχθυώσις*, from *ἰχθύς*, *ichthys*, fish), or Fish-Skin Disease. A disease characterized by a hardened, thickened, rough, and almost horny state of the epidermis, which breaks into small, irregular, scale-like pieces, which do not readily exfoliate, but which if removed are speedily reproduced. In the localities less profoundly altered by the ichthyotic condition, there is hypersecretion of sweat; in the hardened and thickened places, many sudoriparous glands are suppressed and the surface is dry. The disease may affect almost the whole surface or may be confined to a single part; and is most frequently, but not always, congenital. It is attended with no constitutional disturbance. The disease is extremely obstinate, and when congenital may be considered as incurable. The treatment consists in the frequent use of the warm or vapor bath, so as to soften the thickened epidermis and to facilitate its removal, and friction by means of a piece of flannel may be conjoined with the bath. The internal administration of tar, cod-liver oil, etc., sometimes gives relief.

ICHTHYS, ĭk'thĭs (Gk. *ἰχθύς*, *ichthys*, fish). An early Christian symbol. It was discovered that the Greek word for fish consisted of the first letters of the common ascriptive title to Christ: Jesus Christ, the Son of God, the Saviour, or in Greek Ἰ|*ησοῦς* Χ|*ριστὸς* Θ|*εοῦ* Υ|*ιός* Σ|*ωτήρ*. A fish thus became the symbol of Christ, and to make the sign of a fish was to give to the initiated the plainest indication of being a Christian. Accordingly, it entered into the freemasonry of early Christianity. The acrostic appears upon the monuments, and the figure of a fish likewise.

ICICA, ĭs'ĭ-kȧ. See Protium.

ICIL'IUS. The name of a plebeian family in Rome, which produced some of the most zealous defenders of the plebeian interest against the patricians. The name of one of them, betrothed to the unfortunate Virginia, is associated with one of the most touching incidents in the legendary history of Rome. See Appius Claudius Crassus.

ICKELSAMER, ĭk'*e*l-sä'mẽr, Valentin (c.1500-c.1537). A German grammarian. Nothing definite is known of his life. He was born at Rothenburg-an-der-Tauber, it is conjectured, as about 1525 he was schoolmaster there, and from the title-page of one of his works we may gather that he lived for a time, possibly as schoolmaster, at Karlstadt. Afterwards he lived at Erfurt and at Augsburg. His two principal works were: *Rechte Weis auffs kürtzist lesen zu lernen* (c.1527), the foundation of the German phonetic method; and *Teutsche Grammatica* (c.1534), one of the earliest German grammars. Both these books are reprinted in Müller, *Quellenschriften und Geschichte des deutschsprachlichen Unterrichts* (Gotha, 1882).

ICKNIELD (ĭk'nēld) **STREET**, or **WAY**. An ancient road running from Cornwall to Norfolk in England. The name is connected with the Iceni.

ICOD, or **ICOD DE LOS VINOS**, ē-kōᴅ' dȧ lôs vē'nôs. A small town on the northwest coast of Teneriffe, one of the Canaries (q.v.) (Map: Spain, F 5). Population, in 1900, 7282.

ICOLMKILL, ĭ'kōm-kĭl. See Iona.

ICON BASILIKE, ī'kŏn bȧ-sĭl'ĭ-kē. See Eikon Basilike.

ICO'NIUM. A town of Asia Minor. See Konieh.

ICON'OCLASM (from Gk. *εἰκών*, *eikōn*, image + *κλᾶν*, *klan*, to break). The name given to any movement against the religious use of images, but especially to the crusade against their use which excited the whole Eastern Church in the eighth century, dating in its definite character from a decree of the Emperor Leo, the Isaurian, which enjoined the destruction of such images. The question was settled by ecclesiastical authority at the second Council of Nicæa (787), but several succeeding emperors confirmed and attempted to enforce the edict against much popular opposition. The course of the Reformation in Western Europe was marked by wholesale destruction of sacred statues, and many of the English cathedrals still bear traces of the iconoclasm of Cromwell and his soldiers.

ICON'OCLAST. The nom-de-plume of Charles Bradlaugh.

ICONOCLAST EMPERORS. The Byzantine Emperors by whom the contest against iconolatry in the Eastern Church was waged: Leo III., the Isaurian, Constantine V., Leo IV., Leo V., the Armenian, and Theophilus.

ICONOG'RAPHY. A term originally used, in its etymological sense, to signify the science of antique portraiture, i.e. the discussion, enumeration, and history of the portraits of prominent persons in statues, busts, paintings, coins, gems, etc. This science was first resurrected by

Michelangelo and Fulvius Ursinus, and further developed by Canini, in his *Iconografia* (Rome, 1669). The term 'iconography' is occasionally applied to the portraits or images of mythological personages and objects of antiquity—a subject generally treated in the article MYTHOLOGY IN ART. Its chief use, however, is in reference to the attributes, emblems, and symbols with which Christian deities, saints, and conceptions are represented in art.

CHRISTIAN ICONOGRAPHY. In the early Christian centuries the representations were few in number and quite simple, leaving much freedom to the artist. They embraced subjects like the "Good Shepherd" and the emblems of faith, familiar to all. In the fourth and fifth centuries iconography became more complicated. The clergy began to use it as a factor of systematic religious instruction, controlling the representations which were now executed in strict accordance with formulas. Christ, as King of Heaven, was by far the favorite subject from the fourth to the seventh century, while from the eighth to the twelfth, the 'Last Judgment' and scenes from the Revelation were in vogue. There were two schools: the Eastern or Byzantine and the Western or Latino-German. The former was by far the most original and important, dominating not only the East, but Europe during the Carlovingian period, and remaining supreme in Italy until late in the Gothic age. It found its expression in mosaics, frescoes, and illuminated manuscripts, sculpture being excluded as a result of the Iconoclastic conflict. (See BYZANTINE ART.) The iconography of the Romanesque (q.v.) period was meagre and unsystematic, but during the Gothic age an independent Western system originated in France, spreading throughout Europe. In the North it found its chief expression in the sculptures of the great cathedrals, and endeavored to represent the encyclopædic conceptions of the scholastics. (See GOTHIC ART.) In Italy it manifested itself chiefly in painting. Iconography remained under clerical control until, with the Renaissance, the human element superseded the divine, the old subjects being used as a means for the expression of human feeling and artistic ability. The old subjects from biblical history, especially those illustrating the plans of salvation and those from the lives of the saints, continued to be used, the most popular subject being the Madonna with the Christ Child, represented as an earthly mother or in more divine attitudes. The more important subjects of Christian iconography are treated under separate titles, like CHRIST IN ART; HOLY FAMILY. For the important part played by emblems and symbols in iconography, see the article SYMBOLISM, and such special articles as AUREOLE; NIMBUS, etc.

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See also Durand, *Histoire de Dieu, iconographie des personnes divines* (Paris, 1844); Wessely, *Ikonographie Gottes und der Heiligen* (Leipzig, 1875). The best modern works are: Barbier de Montault, *Traité d'iconographie chrétienne* (Paris, 1890), and Detzel, *Die christliche Ikonographie* (Freiburg, 1895). There is no good work on the subject in English, the writings of Mrs. Jameson being unscientific. For iconography in the sense of classical portraiture, consult the monumental works of Visconti: *Iconographie grecque* (3 vols., Paris, 1808); *Iconographie romaine* (3 vols., ib., 1818-20); Bernouilli, *Römische Ikonographie* (Stuttgart, 1882-91); *Griechische Ikonographie* (Munich, 1901).

ICTEROHÆMATURIA, ĭk'tĕr-ō-hĕm'ȧ-tū'-rĭ-ȧ (Neo-Lat., from Gk. *ἴκτερος, ikteros*, jaundice + *αἷμα, haima*, blood + *οὖρον, ouron*, urine). A malignant disease of sheep, due to the action of a blood parasite similar to that of Texas fever. In Europe it is known as carceag. The micro-organism of the disease is found in the blood, urine, spleen, liver, and kidneys. The chief symptoms are fever, bloody urine, and jaundice of the eyelids, nostrils, and sometimes of the skin. Dropsical swellings occur on the head and neck, and the animal assumes a crouching position. During the progress of the disease there is a decrease in the number of red blood-corpuscles and an increase in the number of white corpuscles. Post-mortem examinations reveal an enlargement of the kidneys and a yellow color in the adipose tissue. The disease occurs in restricted localities, where it causes serious losses of sheep. It appears to be safe, however, to raise goats on such infected areas.

ICTI'NUS (Lat., from Gk. Ἰκτῖνος). The chief architect of the age of Pericles, designer of the Parthenon at Athens, the great hall for the mysteries (Telesterion) at Eleusis, and the Temple of Apollo Epicurius at Phigalia in Arcadia. He is said to have written an architectural treatise on the Parthenon.

I'DA (Lat., from Gk. Ἴδη, *Idē*, Ἴδα, *Ida*). A mountain range of Asia Minor, extending through Phrygia and Mysia; now known as Kaz-Dagh. The Granicus, the Simois, the Scamander, and other streams famous in ancient story, flowed from its sides. The highest peak was Mount Gargarus, 5748 feet, near the plain of Troy. Ida was an ancient seat of the worship of Cybele, who was hence called *Idæa Mater*. There was another Ida, almost equally famous, in Crete. This is now called Psiloriti. It rises to a height of about 8000 feet above sea-level. Zeus is said to have been nurtured in a cave in this mountain.

IDA. The princess, in Tennyson's poem of that name.

IDÆ'I DAC'TYLI (Lat., from Gk. *Ἰδαῖοι Δάκτυλοι, Idaioi Daktyloi*). Like the Corybantes and Curetes, attendants upon Cybele, who were originally connected with Mount Ida in Phrygia, whence they were transferred to Mount Ida in Crete, where they watched the infant Zeus. They are supernatural metal-workers, and seem to derive their name from their ready fingers (*δάκτυλος*, finger). The number is given as five or ten, or sometimes even 100. In Greece they appear only at Olympia, where they seem to have been brought from Crete, and were identified with Hercules and four brothers, who first competed in the foot-race.

IDA GROVE. A town and the county-seat of Ida County, Iowa, 80 miles east by south of Sioux City, on the Maple River, and on the Chicago and Northwestern Railroad (Map: Iowa, B 2). It is the commercial centre of a fertile agricultural and stock-raising district, and has grain-elevators and flouring-mills, a broom-factory, etc. A municipal heating plant is in successful operation. Population, in 1890, 1563; in 1900, 1967.

IDAHO, I'då-hō (North American Indian, gem of the mountains). One of the Western States of the American Union, lying between latitudes 42° and 49° N., and longitudes 111° and 117° W. It is bounded on the north by British Columbia, on the east by Montana and Wyoming, on the south by Utah and Nevada, and on the west by Oregon and Washington. The extreme length from north to south along the western boundary is 485 miles. The width varies from about 50 miles in the north to nearly 300 miles in the south. Its area is 84,800 square miles, including 510 square miles covered by lakes.

TOPOGRAPHY. The surface of Idaho is elevated and mostly mountainous. Lying between the main axis of the Rocky Mountains on the east and the Cascades on the west, the State embraces a portion of the Great Basin, a plateau lying 2000 to 5000 feet above the sea, while the northern and eastern parts are traversed by mountain ranges whose loftier summits rise above the snow-line. The principal ranges, the Salmon River and Bitter Root, attain their maximum development near the eastern border, but they send out spurs which extend nearly across the whole width of the State. Northward from the Bitter Root Mountains the system of elevations is continued by the Cœur d'Alêne and Cabinet ranges to the Canadian frontier. In the extreme southeast are the Bear, Blackfoot, and Snake River ranges, offshoots from the main Rocky Mountain system in Wyoming. Nearly the whole area of Idaho is drained into the Columbia by the Kootenai, Clark Fork, Spokane, and Snake rivers. The Snake, or Lewis Fork, is much the largest, its basin within the State covering more than 60,000 square miles, and its course being about 850 miles. It receives important tributaries in the Boise, Payette, Weiser, Owyhee, Salmon, and Clearwater, but its waters are usually shallow. In its course from east to west it passes over three falls, the American, the Shoshone, and the Salmon. The Shoshone Falls have a perpendicular descent of nearly 200 feet. Below the Salmon Falls the river is navigable for light-draught boats to the mouth of the Powder River. In the northern part of the State there are several lake basins, including Pend Oreille, Kaniksu, and Cœur d'Alêne, and in the southeast on the Utah boundary, Bear Lake drains through the Bear River into Great Salt Lake.

CLIMATE AND SOIL. The climate in the more elevated parts is severe, with heavy snowfall in winter; the plains and valleys have a milder climate, free from great extremes, as the summer heat is moderated by mountain breezes. The rainfall in the south is very light, increasing toward the north and east, where the elevated ranges arrest the moist winds. Agriculture is thus limited to the mountain valleys and to the basins of the large rivers, such as the Salmon, Clearwater, Payette, and Boise, where irrigation can be practiced. These basins have a rich alluvial soil that produces excellent crops of cereals and fruits. The uplands have a moderately fertile soil of sands and clays, and are best adapted to grazing.

FLORA AND FAUNA. See paragraphs on these respective topics under ROCKY MOUNTAINS and UNITED STATES.

GEOLOGY AND MINERAL RESOURCES. Geologically Idaho exhibits the general features characteristic of the Rocky Mountain States. Strata of Paleozoic, Mesozoic, and later ages alternate with eruptive and metamorphic rocks. Along the Snake River there is a vast lava-bed forming a desert nearly 400 miles long and 40 to 60 miles wide, the eastern end of a volcanic belt that extends to the Pacific. The fissures from which the molten rock poured out during the late Tertiary period are generally concealed beneath the thick sheets, although their position may be indicated by the lines of flow. The surface of this region is a level plain, almost destitute of vegetation.

MINING. The mineral resources of the State, including deposits of gold, silver, lead, iron, coal, and salt, are of great importance. Gold is obtained from both placer and quartz mines in nearly every county. The first discoveries were made about 1860, and the total output up to 1901 amounted to more than $100,000,000. There has been a decrease in production in late years, owing to the exhaustion of the placer deposits; but with the opening of new fields for quartz mining, such as that at Thunder Mountain, the industry may regain its former prominence. Dredging operations for the recovery of gold from the bed of the Snake River have been carried on successfully for several years. The Cœur d'Alêne lead-silver district in Shoshone County is one of the richest in the United States. The metallic output of Idaho in 1900 was as follows: Gold, $1,727,700; silver, 6,429,100 ounces, valued at $3,986,042; lead, 85,444 short tons; copper, 290,162 pounds.

FORESTS AND FORESTRY. There are in the State 7,000,000 acres of timber land, the exploitation of which has just begun. Almost the whole of the forest area is in the northern part of the State, where the valleys are covered with an exceedingly dense growth. The larger part (3,456,000 acres) of the Bitter Root Timber Reserve is in Idaho. The higher elevation is known as the alpine fir region, constituting nearly three-fourths of the total reserve, the timber in this part being of little value. In the lower zone the yellow pine occupies the drier regions, and the red fir the more moist regions. The Idaho forests have suffered great losses from forest fires.

AGRICULTURE. A very large part of the State is arid and irreclaimable land. In the north the rainfall is greater, and supplies sufficient moisture for grain crops. Three-fourths of the total area is yet public land. This, however, is being rapidly taken up. The great development of the mining industry has created a home market for farm produce, and justifies incurring the heavy expense of irrigation. The channels of the main streams—the Snake and Clearwater—are generally deep, making irrigation impossible or highly expensive. But numerous smaller streams offer excellent irrigation facilities. This is especially true of the head-water region of the Snake River and of the large district, in the western part of the State, lying north of the Snake River and watered by the Boise River and other streams. The Bear Lake region in the southeast corner is also said to be adaptable to irrigation purposes. In 1900, 602.568 acres, or 42.6 per cent. of the improved land, were irrigated. Five and nine-tenths per cent. of the total area, or 3,204,903 acres, were reported for the same year as contained in farms, the average size of which was 183.4 acres. As is common with irrigated lands, intensive farming is the rule, and the soil being very fertile when sufficiently watered, the yield of all crops is very abundant. Hay and forage is the most extensive and valuable crop, the annual acreage for which increased over two and a half times in the last decade of the nineteenth century. Over a third is alfalfa. In the same period the acreage devoted to cereals increased over threefold. Wheat constituted 72 per cent. of the cereal crop for 1899. Oats, barley, and flaxseed are of less importance, and corn is scarcely raised at all. The western part of Idaho, particularly the Boise Basin, is becoming noted for its fruits and vegetables. Apples and prunes are the chief varieties of orchard fruits.

Stock-Raising. Thus far, however, it has been the grazing rather than the farming facilities which have been most extensively utilized. There are 25,000,000 acres of pasture land in the State. In the northern and the mountainous parts of Idaho considerable expense is incurred in stock-raising, owing to the shortness of the summers and the depth of the winter snow. Herders and packers who use mules and horses in the northern mountains through the summer season withdraw to the valley of the Snake River to winter their stock. Along the Snake River, on both sides, there are numerous valleys where winters are not severe enough to prevent cattle and horses from picking up a living for themselves. In the decade ending with 1900 large gains were made in every variety of domestic animals. Sheep are the most important, having produced wool to the value of $2,210.790 in 1899. The following tables show the relative importance and increase of the different varieties of crops and domestic animals:

	Hay and forage, acres	Wheat, acres	Oats, acres	Barley, acres	Corn, acres	Potatoes (Irish), acres
1900	513,656	266,305	64,739	32,798	4,582	9,313
1890	190,501	63,704	21,997	10,004	1,362	3,721

	Dairy cows	Meat cattle	Horses	Mules and asses	Sheep	Swine
1900	51,929	311,605	170,120	2,155	1,965,467	114,080
1890	27,278	192,153	84,135	1,012	357,712	32,188

Manufactures. The manufacturing industry, though not large, is making a vigorous growth. The value of products increased 283 per cent. during the last decade (1890-1900). Flour-milling is of some importance; but the sawing of lumber is the principal industry. The census for 1900 gives the following figures: Number of establishments, 591; capital, $2,941,524; wage-earners, 1477; wages, $862,088; value of products, $4,020,532.

Transportation. The Oregon Short Line, passing through the southern part of the State, offers good railroad facilities to the Snake River Valley. The northern portion of the State is also well provided for by the Great Northern and the Northern Pacific lines. But the great central portion of the State is without railroads. The development of mines within this section has stimulated the construction of wagon roads and trails, but these are altogether inadequate to the needs of the district. The total railway mileage of the State was 1271 miles in 1899.

Banks. October 31, 1900, there were 15 national banks, 10 of which were in operation. Capital stock, $575,000; outstanding circulation, $218,976. Deposits, September 5, 1900, $3,937,423; reserve held, $1,643,497. On June 30, 1900, there were 8 State banks, with a capital aggregating $185,500; deposits, $537,902; resources, $781,465. There were also 6 private banks with resources aggregating $329,320; capital, $81,665; and deposits, $210,693.

Government. Idaho became a State under its present Constitution, adopted by a convention held August 6, 1889. An amendment may be proposed in either branch of the Legislature, and if agreed to by two-thirds of all the members of each House is submitted to the people, and becomes a part of the Constitution if approved by a majority of the electors. If demanded by two-thirds of the members of each House, the question of calling a constitutional convention is submitted to the people, where it is decided by a majority of the electors voting. Suffrage is granted to both male and female citizens who have resided in the State six months, in the county thirty days, and are registered. There are various offenses which cause disqualification for the right of suffrage, among which are plural marriage, or in any manner teaching . . . or encouraging any person to enter into plural marriage, or membership in any organization which encourages it.

Legislative. The number of State Senators cannot exceed 24, nor the Representatives 60, both being elected from counties or districts composed of contiguous undivided counties for the term of two years. The Legislature meets on the first Monday after the first day of January of even years, and at other times when convened by the Governor. Bills for raising revenue must originate in the Lower House. Members receive $5 per day and mileage, but the per diem allowance cannot exceed $300 for any one session.

Executive. The Governor, Lieutenant-Governor, Secretary of State, Auditor, Treasurer, Attorney-General, and Superintendent of Public Instruction are elected for two years at the time and places of voting for members of the Legislature. The Governor, Secretary of State, and Attorney-General constitute a board of pardons. A vetoed bill or item of an appropriation bill is carried over the Governor's head by a two-thirds vote of the members present in each House.

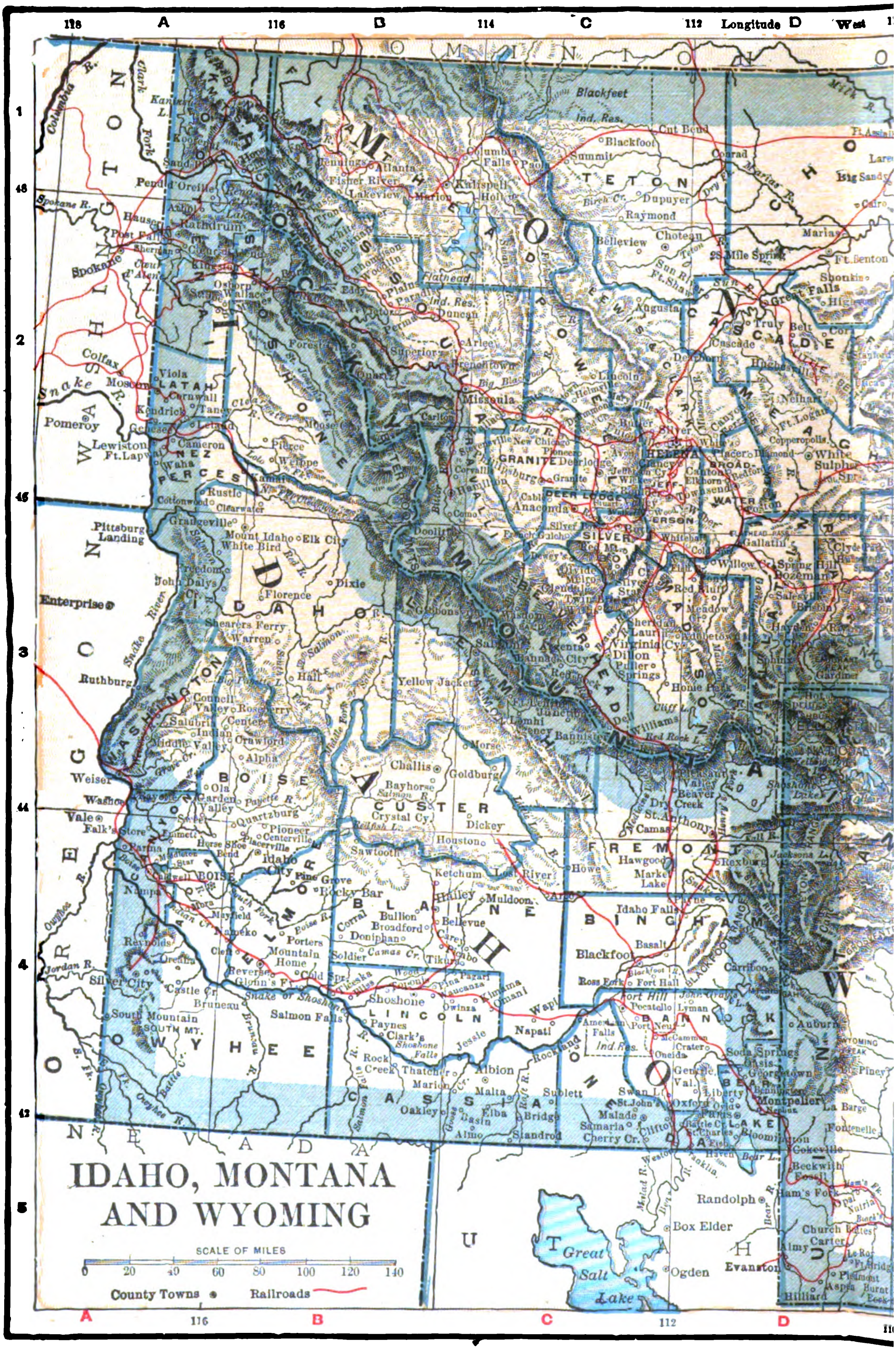
Judicial. The Senate constitutes a court for the trial of impeachments, the Lower House having the sole power of impeachment. The Supreme Court consists of three justices, elected by the State at large for a term of six years. The

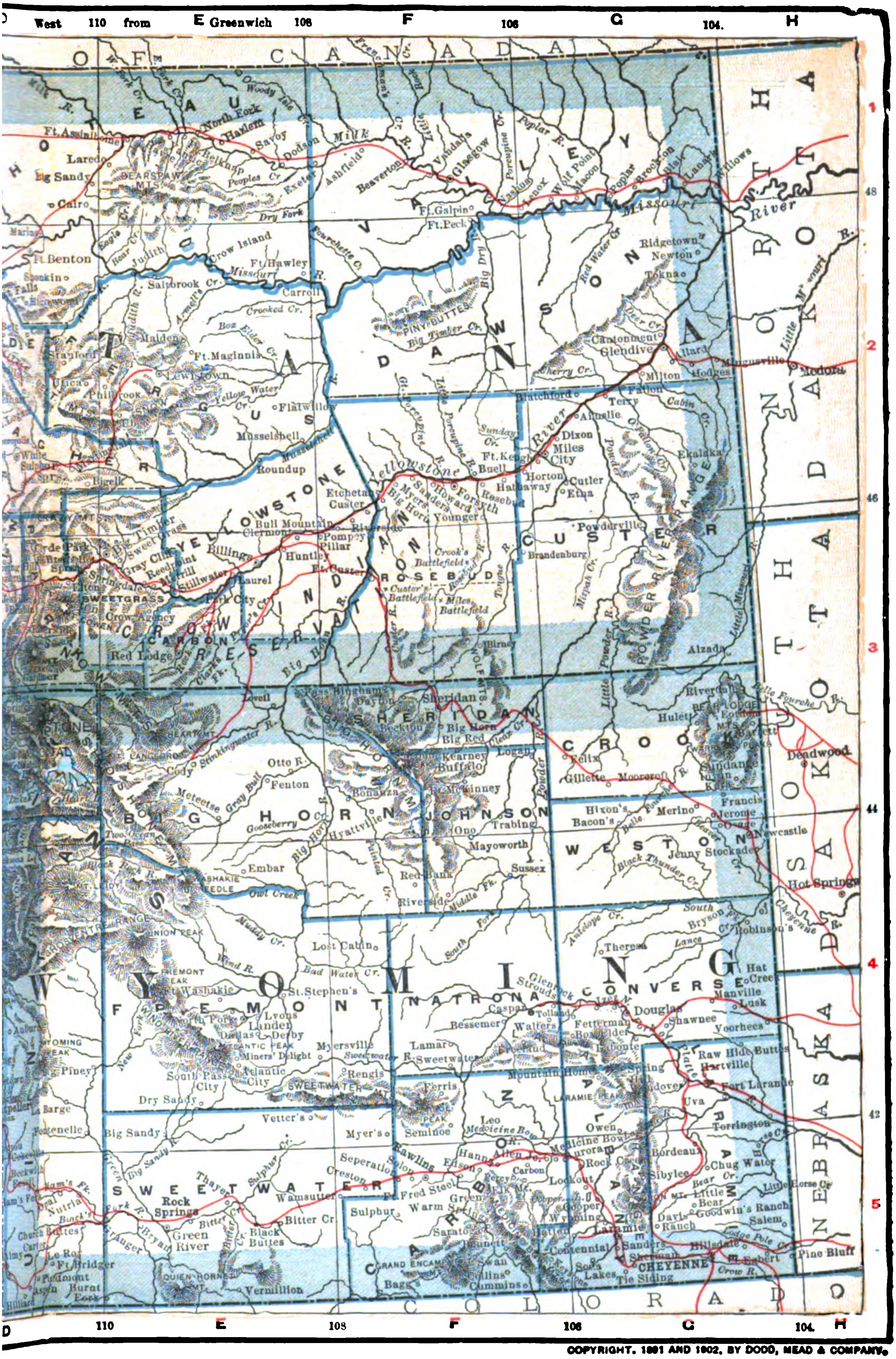
AREA AND POPULATION OF WYOMING BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Albany	G 5	Laramie	4,300	8,865	13,084
Bighorn	E 3	Basin	12,216	.....	4,328
Carbon	F 5	Rawlins	8,018	6,857	9,589
Converse	G 4	Douglas	6,758	2,738	3,337
Crook	G 3	Sundance	5,435	2,338	3,137
Fremont	E 4	Lander	12,653	2,463	5,857
Johnson	F 3	Buffalo	4,168	2,357	2,361
Laramie	F 4	Cheyenne	6,986	16,777	20,181
Natrona	F 4	Casper	5,388	1,094	1,785
Sheridan	F 3	Sheridan	2,569	1,972	5,122
Sweetwater	E 5	Greenriver	10,510	4,941	8,455
Uinta	D 5	Evanston	15,980	7,881	12,223
Weston	G 4	Newcastle	4,594	2,422	3,203
Yellowstone Park	D 3	....	....	.....	369

AREA AND POPULATION OF IDAHO BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Ada	A 4	Boise	1,177	8,368	11,559
Bannock	C 4	Pocatello	3,123	2,629	11,702
Bear Lake	C 4	Paris	964	6,057	7,051
Bingham	C 4	Blackfoot	4,814	13,575	10,447
Blaine	B 4	Hailey	6,309		4,900
Boise	A 3	Idaho City	4,208	3,342	4,174
Canyon	A 4	Caldwell	1,327		7,497
Cassia	B 4	Albion	4,511	3,143	3,951
Custer	B 3	Challis	4,670	2,176	2,049
Elmore	B 4	Mountainhome	2,431	1,870	2,286
Fremont	C 4	Saint Anthony	6,145		12,821
Idaho	A 3	Mount Idaho	11,074	2,955	9,121
Kootenai	A 1	Rathdrum	5,595	4,108	10,216
Latah	A 2	Moscow	1,114	9,173	13,451
Lemhi	C 3	Salmon	4,455	1,915	3,446
Lincoln	B 4	Shoshone	3,270	4,169	1,784
Nez Perces	A 2	Lewiston	1,421	2,847	13,748
Oneida	C 4	Malad City	2,695	6,819	8,933
Owyhee	A 4	Silver City	7,907	2,021	3,804
Shoshone	A 2	Wallace	4,677	5,382	11,950
Washington	A 3	Weiser	2,906	3,836	6,882


IDAHO, MONTANA
AND WYOMING
SCALE OF MILES
0 20 40 60 80 100 120 140
County Towns
Railroads
Longitude
West
118
116
114
112
A
B
C
D
1
2
3
4
5
48
46
44
42
DOMINION
WASHINGTON
OREGON
NEVADA
UTAH
IDAHO
MONTANA
Great Salt Lake
Spokane
Colfax
Moscow
Lewiston
Pomeroy
Grangeville
Mount Idaho
Florence
Warren
Challis
Boise
Idaho City
Weiser
Silver City
Ketchum
Hailey
Bellevue
Shoshone
Blackfoot
Pocatello
Idaho Falls
Montpelier
Missoula
Helena
Butte
Anaconda
Deer Lodge
Great Falls
Ft. Benton
Kalispell
Bozeman
Virginia City
Dillon
Ogden
Evanston
Randolph
Box Elder
Blackfeet Ind. Res.
Flathead Ind. Res.
Snake R.
Salmon R.
Enterprise
Vale
Ruthburg
Pittsburg Landing
Yellow Jacket
Custer
Blaine
Lincoln
Cassia
Owyhee
Elmore
Bingham
Fremont
Bear Lake
Oneida
Lemhi
Nez Perces
Latah
Kootenai
Shoshone
Teton
Cascade
Lewis & Clark
Granite
Deer Lodge
Silver Bow
Jefferson
Madison
Beaverhead
Ravalli
Flathead
Chouteau
Gallatin
Park
Meagher
Broadwater
Wyoming



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AREA AND POPULATION OF MONTANA BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Beaverhead	C 3	Dillon	4,494	4,655	5,615
Broadwater	D 2	Townsend	1,247	.....	2,641
Carbon	E 3	Red Lodge	2,472	....	7,533
Cascade	D 2	Greatfalls	2,764	8,755	25,777
Choteau	D 1	Fort Benton	16,049	4,741	10,966
Custer	G 3	Miles City	20,490	5,308	7,891
Dawson	F 2	Glendive	13,227	2,056	2,443
Deerlodge	C 2	Anaconda	4,252	15,155	17,393
Fergus	E 2	Lewistown	8,928	3,514	6,937
Flathead	B 1	Kalispell	8,419	.....	9,375
Gallatin	D 3	Bozeman	2,588	6,246	9,553
Granite	C 2	Philipsburg	1,543	.....	4,328
Jefferson	C 2	Boulder	1,585	6,026	5,330
Lewis and Clark	C 2	Helena	2,572	19,145	19,171
Madison	C 3	Virginia City	4,443	4,692	7,695
Meagher	D 2	White Sulphur Springs	4,258	4,749	2,526
Missoula	B 2	Missoula	6.385	14,427	13,964
Park	D 3	Livingston	2,788	6,881	7,341
*Powell	C 2	.....	....	.....	.....
Ravalli	C 2	Hamilton	2,771	.....	7,822
*Rosebud	F 3	.....	...	.....	....
Silverbow	C 3	Butte	1,017	23,744	47,635
Sweet Grass	E 3	Bigtimber	2,887	.....	3,086
Teton	C 1	Choteau	7,588	.....	5,080
Valley	F 1	Glasgow	13,368	.....	4,355
Yellowstone	E 3	Billings	3,710	2,065	5,212
Crow Indian Reservation	E 3	.....	5,475	.....	2,660

* Established since the last census was taken.

State is divided into judicial districts, in each of which a judge is elected for a term of four years, and there is a district court in each county at least twice a year. A clerk of the district court is elected for each county, holding office four years. A prosecuting attorney is elected for each organized county for the term of two years. There are also probate courts, justices of the peace, and such other courts as may be established by law. Three-fourths of a jury may render a verdict in a civil action, or five-sixths of a jury in a criminal action for a misdemeanor.

Local Government. The Legislature maintains a uniform system of county government, and by general laws provides for township and precinct organizations, and for the incorporation, organization, and classification of cities and towns. Each county biennially elects county commissioners, a sheriff, treasurer, probate judge, county superintendent of public instruction, assessor, coroner, and surveyor.

Finance. The bonded indebtedness of the State on January 1, 1901, was $443,500. Much of this was incurred in the construction of wagon roads. The outstanding State warrants for the same date were $124,766.

Militia. Able-bodied male residents between the ages of eighteen and forty-five are liable to military duty, except persons having conscientious scruples against bearing arms. These may be exempted from such duty in time of peace. In 1899 the State had an organized militia of 566 officers and men.

Population. The development of the mineral and other resources of the State has induced a rapid growth in the population—almost doubling in the decade 1890-1900. The population consists predominantly of native-born Americans, only about one-sixth being foreign born. As in other mining and grazing States, the male sex is much in excess. The population, by decades, is as follows: in 1870, 14,999; in 1880, 32,610; in 1890, 84,385; in 1900, 161,772. In 1900, Boise, the capital, contained a population of 5957, and Pocatello, 4046.

Indians. According to the last census there were 4226 Indians in the State. There are four reservations, viz. the Fort Hall, Lemhi, Cœur d'Alêne, and Nez Percé. The Indians in the two last-named reservations have made much progress and are practically self-supporting. The others are still dependent upon the Government, receiving about 30 per cent. of their substance from Government rations.

Religion. In religion, Idaho is, like Utah, strongly Mormon. The Catholics are the next strongest, and the Methodists, Baptists, and Presbyterians follow in the order named.

Education. The school officers of the State consist of a superintendent of public instruction, a superintendent of each county, and a board of three trustees in each district. Schools cannot be supported from the public-school fund if any political or sectarian doctrines be taught therein; and the distribution of books, tracts, or documents of this character in them is forbidden by law. The public schools are sustained from the income of a general school fund, also from a county tax, from moneys arising from legal fines and forfeitures, and from fees paid by teachers for certificates of qualification. The basis for distribution of the school money is the number of individuals of school age (five to twenty-one years). Districts may levy special taxes for building or repairing school-houses, and, when the cost of repairs does not exceed $25, the trustees may levy a rate bill, to be collected from such patrons of the school as are able to pay. In 1900 only 4.6 per cent. of the population ten years of age and over were unable to read and write, which was smaller than the corresponding number for the whole country. The State institutions comprise the University of Idaho at Moscow and normal schools at Albion and Lewiston. In connection with the State University an agricultural and mechanical college is maintained. There are also the College of Idaho (Presbyterian) at Caldwell; Episcopal school at Lewiston; Saint Aloysius Academy at Lewiston; Saint Teresa's Academy at Boise; and an industrial school for Cœur d'Alêne Indian girls at Desmet.

Charitable and Penal. Detectives are temporarily sent for purposes of education to the institutions of neighboring States. In 1900 the State insane asylum at Blackfoot contained 118 male and 74 female inmates. In the same year the State prison at Boise contained an average daily enrollment of 150 prisoners.

History. The first white explorers of Idaho were Lewis and Clark in the first decade of the nineteenth century. A mission is reported to have been established at Cœur d'Alêne in 1842, but for many years after that the region was visited only by hunters and prospectors. It was organized as a Territory on March 3, 1863, but with an area more than three times as large as at present, since it included the whole of Montana and nearly all of Wyoming. In May, 1864, a part was set off to Montana, and in 1868 Wyoming was organized. The discovery of gold in 1882 at Cœur d'Alêne in the northern part of the State was followed by a large immigration. In 1889 a new constitution was adopted, and the University of Idaho was established at Moscow. On July 3, 1890, Idaho was admitted to the Union. The presence of a large number of Mormons in the southern part of the State excited great alarm, and as early as 1883 led to hostile action on the part of the Legislature. A law depriving professed polygamists of the right to vote was carried to the United States Supreme Court, and there sustained. In 1893, however, the heads of the Mormon Church rejected polygamy as an essential element of their creed, the anti-Mormon restrictions were removed, and all single-wived Latter Day Saints were admitted to the ballot-box. From May to September, 1892, a miners' strike at Cœur d'Alêne was marked by a number of bloody conflicts between union and non-union workers. Federal troops were dispatched to the scene of disturbance, and military law was proclaimed. The strike failed, but dissatisfaction persisted among the mine workers, and in April, 1899, blazed out in renewed strikes and riots. Martial law was once more proclaimed, and nearly one thousand miners were seized and imprisoned by the United States troops till the strike was crushed out.

In national elections Idaho was carried by the Democrats, or the Democrats and Populists in fusion, in 1892, 1896, and 1900. The Governors since its organization as a Territory have been as follows:

TERRITORIAL

William H. Wallace	1863-64
Caleb Lyon	1864-66
David W. Ballard	1866-70
Gilman Marston	resigned without acting
Thomas M. Bowen	
Thomas W. Bennett	1871-75
D. P. Thompson	1875-76
Mason Brayman	1876-80
John B. Neil	1880-83
John N. Irwin	1883
William M. Bunn	1884-85
Edward A. Stevenson	1885-89
George L. Shoup	1889-90

STATE

George L. Shoup	Republican	1890
Norman B. Willey	"	1891-92
William J. McConnell	"	1893-97
Frank Steunenberg	Democrat-Populist	1897-1901
Frank W. Hunt	" "	1901—

Consult: Onderdonk, *Idaho, Facts and Statistics Concerning Its Mining, Farming, and Industries* (San Francisco, 1885); Bancroft, *Washington, Idaho, and Montana* (San Francisco, 1890).

IDAHO, UNIVERSITY OF. A State educational institution situated at Moscow, Idaho. It was founded in 1889, but was not opened for the reception of students until 1892. It is under the control of five regents, and offers free instruction to students of both sexes. It comprises a course of letters and science, schools of agriculture and applied science, and a preparatory school. It maintains an agricultural experiment station, and has organized farmers' institutes throughout the State. Military drill is required of preparatory students, and of freshmen and sophomores in the university. The degrees of B.A., B.S., B.M., B.E.M., B.E.E., and B.C.E. are conferred. The total attendance averages 350, of whom about 150 are collegiate students. The library contains about 8000 volumes and 10,000 pamphlets. The endowment consists of 286,000 acres of land. The grounds and buildings are valued at $275,000, and the income is approximately $65,000.

IDAHO SPRINGS. A town in Clear Creek County, Colo., 37 miles west of Denver; on the Colorado and Southern Railroad (Map: Colorado, E 2). Picturesquely situated in the famous Clear Creek Cañon, at an elevation of 7543 feet, and having cold and hot soda springs, it is one of the noted summer resorts of the State. In 1859 gold was first discovered in Colorado, at Jackson's Bar, within the present city limits. Up to 1902 the mineral production of the district was over $200,000,000. The town has a number of concentrating mills, machine-shops, lumber-yards, etc., and is famed for its mining tunnels. There is a public library. Population, in 1890, 1338; in 1900, 2502.

IDA'LIUM (Lat., from Gk. Ἰδάλιον, *Idalion*). A town in Cyprus, adjoining which was a forest sacred to Aphrodite, who was hence sometimes called *Idalia*. The site is the modern Dalin.

IDDESLEIGH, ĭdz′lĭ, first Earl of. See NORTHCOTE.

ID'DINGS, JOSEPH PAXSON (1857—). An American geologist, born in Baltimore, Md. He graduated at the Sheffield Scientific School of Yale in 1877, was a graduate student and assistant in mechanical drawing and surveying there until 1878, and continued his studies in geology and microscopic petrography at Columbia University and Heidelberg. From 1880 until 1892 he was in the service of the United States Geological Survey, to which he returned in 1895. In 1892 he became assistant professor, and in 1895 professor, of petrology at the University of Chicago. His Government explorations were described in many reports and contributions to scientific journals. Among his more important writings are: *The Nature and Origin of Lithophysæ and the Lamination of Acid Lavas* (1887), reprinted from the *American Journal of Science; On the Development of Crystallization in the Igneous Rocks of Washoe, Nev.* (1885), with Arnold Hague; and *The Origin of Igneous Rocks* (1892), in the *Bulletin* of the Washington Philosophic[illegible] Society.

ID[illegible] (Norweg., Swed. *id*, roach). A fish (*Leuciscus idus*), closely allied to the roach. It inhabits the lakes of the northern parts of Europe, and ascends rivers in April and May to spawn. It is excellent for the table. A gold-colored variety, called 'orfe,' is bred in Germany, and is sold extensively for ornamental aquariums.

IDEA (Lat., from Gk. *ἰδέα*, form, from *ἰδεῖν*, *idein*, to see; connected with Lat. *videre*, to see, Skt. *vid*, AS. *witan*, Eng. *wit*, to know). The term 'idea' has undergone a radical change of meaning in the history of psychology. "Employed by Plato to express the real form of the intelligible world, in lofty contrast to the unreal images of the sensible, it was lowered by Descartes, who extended it to the objects of our consciousness in general" (Hamilton). In modern philosophy the word has a distinctly empirical flavor. Locke (q.v.) defines idea as "whatsoever is the object of the understanding when a man thinks," "that which the mind is applied about whilst thinking," and the intellectualistic tendencies of the English Associationist school (see ASSOCIATION OF IDEAS) made 'idea' almost equivalent to what is now termed 'mental process' (q.v.). In current psychological usage the word is ei[illegible]er taken in a wide sense to denote the "conscious representation of some object or process of the external world" (Wundt), thus covering perception (q.v.), ideas of memory, and ideas of imagination; or it is restricted to the two latter categories, and opposed to perception, as a strictly re-presentative to a presentative process. Since there is no essential psychological difference between 're-presentation' and 'presentation,' the first and wider application of the term is preferable.

An idea which has been formed, after the manner of a composite photograph, from many ideas of similar character, and which has thus lost definiteness of detail, while it is liable to associative arousal at the hands of a large number of other ideas, is termed an 'abstract' idea. (See ABSTRACTION.) When the abstract idea is symbolic, and not pictorial—when, e.g., it is a word—it is named a 'concept.' Ideational masses of complex but vague contents, which require the operation of active attention to bring their constituents to separate recognition—such as our idea of the sentence that we are about to utter, or (on a still larger scale) our idea of self—are called 'aggregate' ideas. For ideas of memory and imagination, see those titles.

Consult: Sully, *The Human Mind*, vol. i. (London, 1892); Ladd, *Psychology, Descriptive and Explanatory* (New York, 1894); James, *Prin-*

ciples of Psychology (ib., 1890); Titchener, *Outline of Psychology* (New York, 1899).

IDEALISM. In philosophy, the theory that no reality is independent of consciousness. Its ordinary antithesis is realism, or the theory that the reality of things is not dependent upon their relation to consciousness. The *motif* of idealism can best be understood by contrasting idealism with agnosticism or skepticism (q.v.), which admits the existence or at least the possibility of reality in independence of consciousness, but denies the possibility of knowing such reality. A typical skeptic, such as Hume, admits that we do know the contents of our own consciousness. Most skeptics, among them Hume, go to the extent of formulating laws in accordance with which these contents appear and vary. But all this knowledge, satisfactory as it is in its own sphere, is knowledge only of phenomena, or of ideas in the Lockean sense of the word. Skepticism is thus idealistic in its epistemology or theory of knowledge, while anti-idealistic or noncommittal in its ontology (q.v.). The idealist escapes skepticism by refusing to take into consideration the possibility of the existence of a non-ideal reality. The realist asserts the existence of the non-ideal reality which the skeptic either admits or doubts without denying, but usually the realist also asserts the possibility of knowing that reality. Thus the idealist and the realist are antagonistic, both in epistemology and ontology, while the skeptic sides with the idealist in epistemology and yet refuses to take sides against the realist in ontology. Idealism has taken numerous forms. Among these may be mentioned subjective idealism, which assigns only subordinate reality to the content of consciousness and ultimate reality only to the conscious subject (Berkeley and Fichte); objective idealism, which interprets nature as reason made an object to itself (Schelling); absolute idealism, which assigns ultimate reality only to the unity consisting of both object (contents) and consciousness in indissoluble correlation (Hegel); and transcendental idealism, which regards the world of experience as dependent for its order upon the action of a conscious subject working in accordance with laws of thought, but which at the same time denies that ultimate reality is dependent upon such action (Kant). For a criticism of idealism, see Knowledge, Theory of; and see also Plato; Plotinus; Neo-Platonism; Berkeley; Kant; Fichte; Schelling; Hegel; Lotze; Green, Thomas Hill. Consult: Willmann, *Geschichte des Idealismus* (Brunswick, 1894-97), and the authorities referred to under Knowledge, Theory of; Metaphysics.

For the question of idealism in literature, see Romanticism; Realism and Naturalism.

IDEAS, Association of. See Association of Ideas.

IDELER, ē'de-lĕr, Christian Ludwig (1766-1846). A German astronomer and chronologist, born at Gross-Brese, near Perleberg, in Prussia. After holding various offices he received a professorship at the University of Berlin in 1821, and in 1829 he was made a foreign member of the Institute of France. Ideler's most important works are: *Handbuch der mathematischen und technischen Chronologie* (2 vols., 1825-26; 2d ed. 1883), which was the first work that presented a clear view of the reckoning of time among the ancients; and *Die Zeitrechnung der Chinesen* (1839), a supplement to the *Handbuch.* He also wrote, in conjunction with Nolte, handbooks of the French and English languages and literatures, which passed through numerous editions.

IDEN, ī'den, Alexander. A Kentish squire in Shakespeare's *2 Henry VI.*, the slayer of Jack Cade.

IDENTITY (ML. *identitas*, sameness, from *identicus*, same, from Lat. *idem*, same), The Law of. The principle that in any train of thought, such as a syllogism, there must be running through all the differences of contents a oneness of meaning, in which is found the consistency of the phrase of thought. This definition leads to the consideration of the dispute about the meaning of identity. Some have maintained that it is undifferentiated sameness, and that the differences which are found among similar things are accretions of unlikenesses around the core of sameness. Others have maintained that no two objects of consciousness are exactly alike, and that identity is not undifferentiated likeness, but a likeness in difference or a differentiated likeness. The debate centres around the conception of philosophical atomism. It is possible by abstraction to obtain an idea of some quality which is the element of likeness between several objects, and which can be thought as itself undifferentiated. Take color, for instance. In all the different colors, such as red, green, and yellow, can we find by abstraction some one element which is undifferentiatedly alike? Suppose we say that it is that quality of the visual sensation which is due to the stimulus of (relatively) homogeneous light vibrations. (See Color.) Even the answer does not secure undifferentiated likeness. *That* quality thus produced is not one quality, but it is "at least 160 spectral color qualities" (Titchener), each irreducible to any other. But even these are not sharply defined against each other. Although we cannot distinguish all the differences, there is every reason to suppose that there are differences which, though they affect our experience, we are not attentively aware of. There is a continuum of color. (See Continuity, Law of.) If so, there is no undifferential sameness of color, although there is a sameness which we recognized *in* the differences. There is a oneness in all the reds, which oneness we *cannot isolate, although we can recognize.* So there is a oneness in all color, unisolable but distinguishable and recognizable. What is true of color is true of everything else. Atomistic explanation of color is false to fact. Undifferentiated sameness is not offered by experience. Hence an identity might be defined as an unisolable but distinguishable oneness of attributes in objects which at the same time might present a multiplicity within the same attributes. For the atomistic views of identity, consult James, *Principles of Psychology* (New York, 1893); for the opposite view, Bradley, *Principles of Logic,* books i., ii. (London, 1883); also the discussion between James and Bradley in *Mind*, new series, vol. ii. (London, 1893); Bradley, *Appearance and Reality* (see index for pertinent passages) (London, 1897); Bosanquet, *Logic* (see index for pertinent passages) (London, 1888); Fullerton, *Sameness and Identity* (Philadelphia, 1890); also the authorities referred to under Logic; Knowledge, Theory of.

ID'EOG'RAPHY (from Gk. *ἰδέα*, *idea*, idea + *-γραφία*, *-graphia*, a writing, from *γράφειν*, *graphein*, to write). The art of representing ideas by graphic signs, as may be seen in the hieroglyphics (q.v.) found on the monumental relics of Egypt.

IDES. See under KALENDS.

IDIOCY (from Gk. *ἰδιωτεία*, *idiōteia*, uncouthness, from *ἰδιώτης*, *idiōtēs*, private citizen, from *ἴδιος*, *idios;* connected ultimately with Lat. *suus*, Skt. *sva*, own). A condition of arrest of development of the brain, and, in consequence, of the intellectual faculties, of the infant or child. If the non-development is such that the child is capable of feeding himself and of appreciating enough of his surroundings to avoid injury, the condition is usually termed *imbecility*. If there is no such evidence of mental capacity, *idiocy* is the term usually employed. *Feeble-mindedness* occupies an intermediate position between normality and imbecility. The defect or disease of the brain which interferes with normal evolution may be congenital or acquired; the cerebral functions may be all more or less involved. Ribot and also Sollier maintain that the slow development of the cerebral faculties is due to want of attention; that spontaneous attention is caused by affective states brought into action by sensations, and that those young children are the most attentive whose nervous systems are most easily stimulated. Hence the faculty of attention is closely related to the activity of the sensations. The greater the power of attention, the more intelligent does the individual become. In idiocy, owing to the diminution or loss of the power of attention, the perceptions aroused by sensations are more or less indefinite, and the resultant idea likewise ill-defined. Sensations become more numerous as the organism develops, and the lack of ideas and recognitions becomes more noticeable. Frederick Peterson, whose translation of Sollier we quote, sounds a warning that there are other faculties of mind, such as will and memory, which are absolutely necessary to all subsequent mental activity, and adds that lack of the power of attention, while common in idiocy, cannot be taken in any way as distinguishing this condition of mind from other forms of mental impairment. Frequently somatic and especially cranial and facial characteristics are noticeable upon the birth of the idiot, though idiocy exists also when physical evidence is wanting. An idiot may not take the breast, may cry without motive and with different notes from normal children. Deafness or blindness may be congenital. The senses of smell and of taste may be undeveloped. The movements of the eyes may be irregular. The idiot may be slow in responding to the stimulus of touch; he may not laugh; thermic sensibility is diminished; a constant rhythmic, automatic motion may be present; he may not learn to walk, and all voluntary movements may be acquired late in youth, and imperfectly. Organic sensations are blunted, including hunger, thirst, desire for defecation or urination. Lack of the faculty of attention exists, owing to defective senses which convey feeble impressions to the brain, as well as to a lack of the affective state; the internal form of attention (reflection of Ribot) is absent or deficient in the idiot. He is practically incapable of preoccupation. His instincts are defective, whether of hunger or of self-preservation; while the instinct of irritation is very strong; and the sexual instinct is seldom normal, being exaggerated, impaired, absent, or perverted. Occasionally remarkable special aptitudes are seen in idiots in the direction of music, mathematics, mechanical arts, drawing, painting, memory for facts or dates, playing certain games, and a low order of wit or drollery. It is said that the Court fools and jesters of ancient times were idiots of high grade or imbeciles, until others, seeing the emolument to be obtained, studied and practiced the art. Ribot says that Sikorski is authority for the statement that the activity and attention of normal children are mainly developed through play. Idiots for the greater part manifest little tendency to play, clinging to the simplest games of infancy and preferring solitary pastimes. Others of higher grade prefer noisy, destructive sports, and traits of brutality, selfishness, and quarrelsomeness are apparent. Civility and politeness are rarely acquired. Destructiveness, evidenced in their play, may develop into a vicious satisfaction in inflicting injury, commission of arson, or of homicide, or of self-mutilation. Sentiments and sensation are rudimentary or absent: the absence of ideas of right and wrong, the varying respect for authority, the absence of religious feeling, and the absence of veracity being especially noticeable.

It has been said that idiot children sometimes show facial characteristics at birth. They are always ungracious, uncouth, or ugly in figure, face, attitudes, or movements. Very common among them are misshapen or unsymmetrical heads, dwarfishness, lack of proportion of the limbs, stooping and slovenly postures, deformities of the hands or feet, and awkward gait (Peterson). The expression of the face varies from apathy to constant laughing, leering, or scowling; the mental characteristics being evident also. There may be deformities of the iris, cornea, or the lids of the eyes, as well as malformation of the nose, ears, and chin. Microcephalus, hydrocephalus, and cretinism are found in some idiots. There are speech defects. Sollier finds two kinds of mutism in idiots, a motor and a sensory aphasia (q.v.). In the first the idiot cannot talk, though he understands; in the second he understands nothing which is said. Language is developed late in the idiots who talk. As stated, when infants, their notes are not normal, but meaningless and monotonous cries take the place of the usual crowing of a baby. Speech disturbances are common, as regards both absence of words to express ideas, or imperfections of grammar, and also excessive and infinite loquacity. Reading is impossible in idiots who suffer from defects of the visual centres or the visual apparatus. The writing centre is the latest part of the linguistic cerebral equipment to be developed, together with its association tracts. They learn to reproduce letters, though never to write well, and they exhibit a tendency to write with the left hand, and also to write from right to left. They execute drawing only by copying, without perspective, or produce scrawls of fantastic nature.

From preceding statements it has been gathered that the intelligence of the idiot varies from the normal in different degrees. He has fewer ideas than the imbecile. Imitation does not furnish ideas for him: it simply centres on mechanism, except in the idiots of higher grade, in whom the idea, assimilated by the intelligence, unfortunately is not retained, but lost. Sollier reminds us that memory is hereditary, organic, or acquired. (See MEMORY.) Hereditary memory exists often in idiots. Organic memory, or unconscious memory (as of walking and other associated movements), though sometimes completely absent in idiots, owing to defective nerve-centres and lack of attention, is nevertheless better developed than either hereditary or acquired memory. Attention being an absolute requisite for acquired memory, idiots are rarely possessed of this power. Memory fixed by repetition of sensation, without emotional basis, is found in educable idiots; as, e.g. memory of the location of the dining-room, of the bed, etc. The phenomenon of specialized memories, such as those for musical airs, or dates, for example, is inexplicable. Association of ideas, occurring, as it does, by resemblance, contrast, and contiguity, hardly exists in idiots. They experience an association of sensations. Judgment and reason also are very faulty. Volitions do not exist in the lowest order of idiots. Voluntary control of the sphincters occurs in idiots who walk only after they have learned to do so. In higher idiots the will is manifested by more complex movements than actions accomplished for the satisfaction of natural needs and appetites; but even these complex movements may become secondarily automatic. Self-respect, to which one may appeal in an imbecile, is little developed in the idiot.

As to the psychological development of an idiot points are reached in every case at which education ceases, and further mental progress is impossible. Peterson places the limits as follows: In the inferior types intellectual progress ceases at the age of six or seven, and sentiments and senses continue their development to eighteen or twenty; while in the superior grades the improvement of senses, sentiments, and intellect may all cease about puberty. Retrogression may occur, following the same law as dementia, to wit, enfeeblement of will, intelligence, sentiments, and sensations in this order. The causes of idiocy are various. Its elements are in many instances hereditary, that is to say, a course of conduct in a parent which tends to degeneration, such as excessive alcoholic indulgence of any kind, will tend to induce arrested normal healthy development in offspring. Other causes are injuries received during childbirth, acute disease of the brain or its coverings in early infancy, or even while intrauterine. Injury to the brain may result in idiocy. Chronic disease of the brain-coverings, tuberculosis, tumors within the brain, hydrocephalus, are other causes. A peculiar type of idiocy is due to mal-development of the thyroid gland. This is called cretinism or myxedematous idiocy. The attempt to educate idiots commenced in the seventeenth century with an experiment of Saint Vincent de Paul at the Priory of Saint Lazarus. His efforts to teach idiots, though continued for many years, were not successful. In 1799 the celebrated Itard took a wild boy found in the forests of Aveyron and attempted to teach him; and although the success in this particular case was slight, he believed that he had discovered methods and facts which would be of use in other cases. These he communicated to his pupil, Dr. Edouard Seguin, who, in 1838, opened a school for idiots in the Hospital for Incurables in Paris. He met with success enough to have the idiots at the Bicêtre sent to the hospital to be instructed, and in the course of three years he received the approval of the French Academy. Dr. Seguin adopted a system involving the theory that idiocy was prolonged infancy. His practice, founded upon this, was to excite and continue the process of development. Of course a variable success attended the experiment. The art of effecting such development requires much knowledge, tact, and patience. Different kinds of idiots need different stimulants, physical and mental. Pure air, good nutritious food, exercise; in short, any treatment which is calculated to increase the bodily and mental functions will improve the idiot. Wherever his interest can be awakened there will be a mental stimulus, and as the tendency of development is toward a normal standard, more or less improvement must follow. Dr. Seguin removed to New York City, where he established a school for idiots and feeble-minded children, which was very successful. Other similar institutions exist in various parts of the country. Statistics are unreliable, as confusion is apt to be caused by the inclusion of epileptics and insane people with the feeble-minded and imbecile. In 1890 it was stated that there were 95,500 'feeble-minded or idiotic' persons in the United States.

Consult: Sollier, *Psychologie de l'idiot et de l'imbécile* (Paris, 1891); Preyer, *The Mind of the Child*, trans. by H. W. Brown (New York, 1893); Ribot, *The Psychology of Attention* (Chicago, 1894); Bourneville, *Assistance, traitement et éducation des enfants idiots et dégénérés* (Paris, 1895); Peterson, "The Psychology of the Idiot," in *American Journal of Insanity* (Utica, New York, 1896).

IDIOCY (in law). A total lack of reasoning powers, or of those intellectual faculties by which man is peculiarly distinguished. Its legal consequences, so far as contract and tort obligations as well as criminal responsibility are concerned, are the same as those of insanity (q.v.). The term is ordinarily limited to those who have had no understanding from birth, although some courts have declared that it is properly applicable to those who have become totally imbecile from sickness or other causes, as well as to congenital fools. In case of one who has never possessed a glimmer of reason, the law presumes that he will never attain any. Hence the custody of his person and of his lands formerly vested in the lord of the fee or of the manor. Because of the abuse of this power, Parliament transferred the wardship of idiots to the King, by statute of 17 Ed. II., c. 9. In this country the care of their persons and property is provided for by statute or safeguarded by constitutional provisions. For example, the present Constitution of New York vests the care of idiots in the State Board of Charities, and not in the Commission of Lunacy. It was laid down by ancient English writers upon law that a man who is born blind, deaf, and dumb can have no understanding, and hence cannot make a valid contract, gift, or grant. This doctrine had its origin in a misconception of certain texts of the civil law, which declared that one who was deaf or dumb could not be a party to a *stipulatio*, that is, a contract which was entered into by an oral question and answer, in certain formal words. It is quite clear that a dumb person could not be a party to this formal contract, for he could not ask the question nor speak the response. Deafness also incapacitated one for such a contract, by preventing his hearing the question or the answer. But the civil law never countenanced the presumption that a deaf and dumb person was mentally incapable of entering into a consensual contract. In modern English law the presumption is only *prima facie*, and may be repelled by evidence, that the particular person whose competency is brought into question does possess sufficient intelligence to rank as one of sound mind. Consult: the *Commentaries* of Blackstone and Kent; Holmes, *Misunderstandings of the Civil Law*, 6 Am. Law Rev., 37; and the authorities referred to under MEDICAL JURISPRUDENCE.

IDIOM (Lat. *idioma*, Gk. *ἰδίωμα*, *idiōma*, peculiarity, from *ἰδιοῦσθαι*, *idiousthai*, to make one's own, from *ἴδιος*, *idios*, one's own, peculiar). A term used to denote a phrase or form of words approved by the general usage of a language, while in many cases it will admit of neither grammatical nor logical analysis. In a broader sense, it denotes the genius or peculiar cast of a language; hence it is often applied to a peculiar form or variation of a language, a dialect.

ID'IOP'ATHY (from Gk. *ἰδιοπάθεια*, *idiopatheia*, peculiar feeling, from *ἰδιοπαθής*, *idiopathēs*, affected peculiarly, from *ἴδιος*, *idios*, peculiar + *πάθος*, *pathos*, feeling). Idiosyncrasy (q.v.); peculiar susceptibility. The term is also used of the quality of being idiopathic. A disease is called idiopathic as distinguished from one resulting from a wound, traumatic. An idiopathic disease is therefore an idiopathy.

ID'IOSYN'CRASY (Gk. *ἰδιοσυγκρασία*, *idiosynkrasia*, peculiar temperament, from *ἴδιος*, *idios*, peculiar + *σύγκρασις*, *synkrasis*, mixture, from *συγκεραννύναι*, *synkerannynai*, to mix together, from *σύν*, *syn*, together + *κεραννύναι*, *kerannynai*, to mix, from *κρᾶσις*, *krasis*, mixture). An individual trait or constitutional peculiarity. Thus, there are persons who have a great dislike to particular kinds of food, smells, sounds, etc., which to most persons are agreeable; and, on the other hand, a desire is sometimes manifested for things generally disliked. In particular individuals an eruption of the skin will be caused by eating strawberries, or fainting by the smell of a rose, when the person is unaware of the cause. Idiosyncrasies also occur in consequence of which certain medicines become inoperative, or certain poisons harmless. Idiosyncrasies are either permanent or temporary, sometimes arising from mere morbid conditions, and disappearing along with them. The term is also employed to denote *mental*, as well as *physical* peculiarities, which are often signs of insanity, such as baseless antipathies to certain persons, bizarre arrangement of articles in one's room, permanent dread of passing certain objects, etc.

IDLE LAKE. In Spenser's *Faerie Queene*, the lake on which Phædria sailed.

IDLER, THE. The title of a series of papers by Dr. Johnson, published in Payne's *Universal Chronicle* (1758-60).

IDOL (OF. *idole*, Lat. *idolum*, from Gk. *εἴδωλον*, *eidōlon*, image, from *εἰδέναι*, *eidenai*, Skt. *vid*, to know, Lat. *videre*, to see). An image intended to represent a deity, and to be adored as such. The act of such adoration is idolatry. Through theological usage, the term idolatry has come to mean in a general sense any worship or obeisance paid to any other than the Supreme Being as conceived by Judaism, Christianity, or Islam. Confining ourselves to the more restricted usage, the worship of idols appears to be a phase of religious evolution that is natural to man at a certain stage of culture. It arises from the desire to furnish some tangible evidence of the presence of the powers upon whom man feels himself to be dependent. In this sense idolatry is to be distinguished from the attribution of divine force to a sacred stone, river, or other object. The sanctity is inherent, for one reason or the other, in such objects themselves, whereas the sanctity of an idol is due to its being a symbol. It becomes evident, therefore, that while the direct worship of objects is a link in leading to a symbolical image-worship, the latter belongs to a phase of religious thought transcending the more primitive manifestations of the religious instinct. This thesis finds an illustration in the religious history of the Semites, as well as in that of the Greeks and Romans. The localization of nature deities, such as the sun, moon, and certain planets, led in the case of the Babylonians and Egyptians to representation of the gods of a more or less fanciful character, and the development of the art instinct acts as a powerful factor in promoting and maintaining the worship of these gods under the form of images of men or animals, or of a combination of the two. The influence exerted by Babylonian and Egyptian culture led the nations of Palestine—notably the Phœnicians—to replace poles and stones by symbolical representations of the gods, and the Hebrews likewise after they had advanced to the agricultural stage fell a prey to these same influences until, through the reaction brought about by the teachings of the prophets, an emphatic protest against all manner of idolatry is embodied in the religious system and cult of post-exilic Judaism. The rise of Christianity helped to spread the doctrine further, though the Christian veneration of sacred images (see IMAGE-WORSHIP) was by some confounded with idolatry. Islam struck at the root of the matter by forbidding the making of any representation of any living thing, whether intended to be worshiped or not (cf. Ex. xx. 4). To give life was felt to be the exclusive prerogative of God, and to attempt to reproduce even the external form of a living thing was regarded as impiety. As a consequence wherever Islam secured a foothold idolatry was doomed. Zoroastrianism at least did not encourage idolatry, but it is noticeable that in the extreme East—India, China, and Japan—idolatry was not only reconciled with the remarkable development of religious thought that took place in those regions, but its hold seemed to grow stronger with each new phase in this evolution.

IDOM'ENEUS (Lat., from Gk. Ἰδομενεύς). The grandson of Minos, and son of Deucalion of Crete. As ruler of Cnosus and Crete, he led 80 ships to Troy. In the *Iliad* he is described as one of the mightiest of the heroes, and in the battle at the ships he plays a leading part. The early history makes him return to his home in safety, and receive there in due time an honorable burial. In later writers he was represented as vowing during a storm to sacrifice to Poseidon the first living thing that met him on a safe return to Crete. The victim was his son, and his subjects drove him forth. He wandered to Calabria, where he built a temple to Athena, and later from Italy to Asia Minor, where he established a shrine of Apollo, near Colophon. Here he died and was buried.

IDRAC, ē'dräk', ANTOINE (1849-84). A French sculptor, born at Toulouse. He studied under Guillaume, Cavelier, and Falguière, and at twenty-four won the Prix de Rome. He displayed especial mastery of the nude and was rapidly rising in his profession when he died, aged thirty-five. Idrac's works are: "Cupid Stung by a Bee," a theme of the Greek anthology (1878), bought by the French Government; "Mercury Discovering the Caduceus," a marble figure which won the first medal and is now in the Luxembourg Museum; and a "Salambo" (1882), which showed his ability to represent the supple nude form, won him the French Legion of Honor and received a first prize at the Munich Exposition of 1883.

IDRIA, ē'drē-ä. An important mining town in the Austrian Crownland of Carniola, situated in a deep caldron-shaped valley on the Idriza, 22 miles west-southwest of Laibach (Map: Austria, D 4). Idria is famous for its quicksilver-mines, believed to be the richest in Europe. They were discovered in 1497, and have been operated by the State since 1580, employing altogether about 1500 persons, and yielding over 500 tons of quicksilver annually. Population, in 1890, 5084; in 1900, 5772.

IDRISITES. A dynasty of Arab rulers in the northwest of Africa. The founder of the line was Idris of the race of Ali, who about 785 united a number of the native Berber tribes into a kingdom under his sway. His son Idris II. founded Fez and greatly increased his possessions by conquest, but on his death the kingdom was divided among his sons, and, thus weakened, it fell an easy prey to the power of the Fatimites in the third decade of the tenth century.

ID'UMÆ'A. See EDOM.

IDUN, ē'dōōn (Icel. *Iþunn;* connected with *þ*, energy, *iþenn*, energetic, OHG. *ila*, energy). The name of a goddess of Scandinavian mythology. She was the daughter of the dwarf Ivald; but being received among the Æsir, she became the wife of Bragi. Idun possessed a box of apples, by the use of which the gods preserved their perpetual youth. She was carried off by the giant Thiassi, with the assistance of Loki. But the gods, beginning to grow old and gray without their apples, sent Loki after her, and, changing himself into a falcon and Idun into a nut, he returned with her to Asgard. In this myth Idun represents spring, and Thiassi winter. According to Sophus Bugge, the main story may be closely connected with the Greek myth of the golden apples of the Hesperides in an Irish version. The introduction of edible apples at a time when this fruit was unknown in the North seems to imply a foreign source.

ID'YA. A poetical name of Britannia.

I'DYL, or **I'DYLL** (from Fr. *idylle*, Lat. *idyllium*, from Gk. *εἰδύλλιον*, *eidyllion*, short poem, from *εἶδος*, *eidos*, form, scene). A term generally used to designate a species of poems representing scenes of pastoral or out-of-door life. It is, however, an error to suppose that the idyl is exclusively pastoral; certainly, there is no warrant for such a notion in either ancient or modern usage. Of the thirty-one idyls attributed to Theocritus, only ten are bucolic.

IDYLLS OF THE KING. Twelve poems by Tennyson, published between 1842 and 1885, based on the Arthurian romances. The titles are: "The Coming of Arthur," "Gareth and Lynette," "The Marriage of Geraint," "Geraint and Enid," "Balin and Balan," "Merlin and Vivien," "Lancelot and Elaine," "The Holy Grail," "Pelleas and Ettarre," "The Last Tournament," "Guinevere," "The Passing of Arthur."

IDZŬ, ē'dzōō. One of the fifteen provinces of Japan which make up the Tōkaidō or 'East Sea Circuit,' and through which the highway called the Tōkaidō runs. It is a mountainous peninsula, with numerous bays and promontories, 32 miles long and 16 wide, lying between the bays of Sagami on the east and Suruga on the west. Geologically and orographically it forms part of the volcanic range of mountains with which the name Hakone is associated. Its most important river is the Kanōgawa, which flows north into Suruga Bay, and its highest peak is Amagi-san, with a height of about 4800 feet. Its chief towns are Mishima, on the Tōkaidō, and the small but beautiful port of Shimoda, on the southeast coast. The rearing of silkworms and the reeling of silk form the principal industry of the peninsula. It abounds in hot springs and watering-places, the chief of which is Atami, about 45 miles from Yokohama. To Idzu belong, both geologically and politically, the 'Seven Volcanic Islands,' of which Oshima or Vries Island, 38 miles from the mainland, is the chief, and further south Hachi-joshima, long used as a place of banishment. See Rein, *Japan* (London, 1884); and Satow and Hawes, *Handbook for Travellers in Central and Northern Japan* (Yokohama, 1881).

IERNE, ī-ĕr'nē. An ancient Greek name for Ireland.

IF, ēf. A rocky island about two miles west of Marseilles, with a castle, the Château d'If, built in 1529, and later used as a State prison. In it Mirabeau, Philippe Egalité, and others were confined. The castle is most widely known through Dumas's *Count of Monte Cristo.*

IFFLAND, ĭf'länt, AUGUST WILHELM (1759-1814). A German actor and dramatist. He was born at Hanover and was intended for the Church, but before he was nineteen the stage had become his choice. He went to Gotha, where he studied under Gotter, Beck, Beil, and Ekhof, and thence in 1779 to Mannheim, where he first became famous. Differences with his manager induced Iffland in 1796 to accept the post of director in the Berlin National Theatre. Fifteen years afterwards he was made superintendent of all the royal theatres, and under his management the Berlin stage reached its highest point. But he was not merely an able manager. As an actor he showed himself artistic, painstaking, and minute, strong in comedy of every-day life. Voice and figure unfitted him for tragedy. For the stage he translated and wrote himself, for the most part, plays of over-great sentiment, and too strongly urged didactic purpose. But in them he displayed much literary talent and great practical knowledge of the stage. *Die Jäger*, *Dienstpflicht*, *Der Spieler*, and *Die Mündel* kept the stage for a century. Iffland's dramatic criticism is to be found in his *Almanach für Theater und Theaterfreunde* (1806-11), and *Theorie der Schauspielkunst* (1815). Consult the autobiography, *Meine theatralische Laufbahn* (ed. by Holstein, Heilbronn, 1886); Duncker, *Iffland in seinen Schriften* (Berlin, 1859); and Genée, *Ifflands Berliner Theaterleitung* (Berlin, 1896).

IFNI, ēf′nė. A seaport town of Africa, situated on the western coast of Morocco, opposite the Canary Islands. It was ceded by Morocco to Spain in 1883. Population, about 6000.

IFUGAO, ē′fo͞o-gä′ō. A head-hunting Malayan people in Nueva Vizcaya and Isabella provinces, Luzon. Their speech is distinct with many subdivisions. See Philippine Islands.

IGBARA, ēg′bȧ-rȧ, or **IGBIRA**, ēg′bĭ-rȧ. A negro people of the Sudan living at Nupé on the right bank of the Niger and southward to Yoruba. They are said to be industrious and commercial. Their language belongs to the same linguistic group with Nupé, Ewe, and Tshi. Half a century ago the Kingdom of Nupé was subdued by the Hamitic Fulas, and the Igbaras, together with other kindred tribes, were brought under Moslem influence, though many are still pagan. The ruins of Fende or Panda, the capital of this once powerful dominion, are still to be seen. They are governed by a Fulah Emir, but are within the British Protectorate. See Fulah.

IGERNA, ĭ-gẽr′nȧ, **IGERNE**, ĭ-gẽrn′, **IGRAINE**, ĭ-grān′, or **YGNERNE**, ĭg-nẽrn′. In the Arthurian romance, the wife of Gorlois, Duke of Cornwall. She was loved by Uther, King of Britain, and by him became the mother of Arthur.

IGLAU, ē′glou. An ancient and, next to Brünn, the largest town of the Austrian Crownland of Moravia, situated on the Iglawa and on the Bohemian frontier (Map: Austria, D 2). It has a fine market-place; a number of interesting churches, including one dating from the eighth century; a Rathaus; barracks (formerly a Dominican monastery); and a cloth hall. In the Middle Ages Iglau was an important mining centre, but since the Thirty Years' War mining has been practically extinct, and the manufacturing of cloth is now the foremost industry. There are numerous weaving, spinning, and dyeing establishments, a cigar-factory employing over 2500 hands, potteries, and flour-mills. There is also a considerable trade in agricultural products, cloths, and lumber. Population, in 1890, 23,716; in 1900, 24,387, chiefly German Catholics, and including over 4000 Czechs. Iglau is a town of great antiquity, its silver-mines having been worked as early as the eighth century. By the Treaty of Iglau, in 1436, a settlement was effected between the Hussites and Sigismund, who was acknowledged King of Bohemia. The town suffered heavily from a fire in 1523, and was thrice captured by the Swedes during the Thirty Years' War.

IGLESIAS, ė-glā′sė-ȧs, José Maria (1823—). A Mexican statesman and author. He was born in the City of Mexico, studied law in the university there, and later became professor of jurisprudence in that institution. He early entered politics, and speedily attracted attention by his natural ability. Political preferment rewarded his loyalty to the Government, and in 1857 he became Secretary of Justice, and a little later Secretary of the Treasury. From 1853 to 1867 he was again Secretary of Justice. In 1868 he was a member of the General Congress, and the same year was appointed Secretary of the Interior by Juarez, to whose fluctuating fortunes he had clung with unswerving fidelity. In 1873 he became president of the Supreme Court, and by virtue of that office assumed the Presidency of the Republic when Lerdo de Tejada was overthrown in 1876, but was soon compelled to give up the position to Diaz. After 1878 he applied himself to journalism, and published several works on Mexican history.

IGLESIAS DE LA CASA, dȧ lȧ kä′sȧ, José (1748-91). A Spanish poet, born at Salamanca. His earliest writings were satires in the form of epigrams and *letrillas* directed against contemporary society. After entering the Church he wrote works of a graver nature, and later his verses were merely rhymed theological discussions. His style has much clearness and animation, but lacks originality. The first edition of his works is that of Salamanca (1798). The idyls and romances included in this edition are not so well known as his poetry, and are of less value.

IGNACIO, ėg-nä′thė-ō, José de Jesu Maria (1721-80). A German Jesuit, whose secular name was Herman Loessing. He was born in Paderborn, and began his clerical career as professor of rhetoric and philosophy in the College of Old Mexico. While there he became interested in the antiquities of the country, and spent about ten years in collecting them. Returning to the fatherland with his spoils, he became librarian to the Archbishop of Cologne (1768), and published *De Arte Hieroglyphum Mexicanorum* (1774), *Historia Novæ Hispaniæ* (1777), *Reisen in Neu-Spanien* (1778), *Historia Regni Aztecorum* (1780), and *Cosmographia* (1780). He became blind before his death, and after it his notes were incorporated into two works by Chastelard.

IGNA′RO (Lat., I do not know). A character in Spenser's *Faerie Queene*, who answered all questions with "I cannot tell."

IGNATIEFF, ĭg-nä′tyĕf, Nikolai Pavlovitch, Count (1832—). A Russian general and diplomat, born in Saint Petersburg, January 29, 1832. He was the son of a favorite officer of the Emperor Nicholas, and was commissioned in the Guards in 1849; he served in the Crimean War, and was made a colonel in 1856, and a major-general in 1858. In the latter year he was made diplomatic attaché to General Muravieff, Governor of East Siberia, and in this capacity negotiated with China the Treaty of Aigun (May 28, 1858), by which Russia came into possession of the region of the Amur. He was subsequently sent on a special mission to Khiva and Bokhara, and as Plenipotentiary to Peking in 1860. He was made Adjutant-General of the Czar in 1863, and was placed at the head of the Asiatic department of the Ministry of Foreign Affairs. In the following year he was sent to Constantinople to represent the Czar at the Court of the Sultan, and he remained in this important post until the outbreak of the Russo-Turkish war in 1877. He was an active agent in the events of this exciting and critical period, encouraging the restlessness of the Christian peoples of the Balkans, while endeavoring to maintain the Russian influence over the Sultan. In the pursuit of his ends Ignatieff did not hesitate to resort to duplicity and the basest kind of intrigue, and succeeded in gaining the sobriquet of 'Liar Pasha.' Through such means he was quite successful in maintaining the Russian influence during the life of Abdul Aziz, but after the latter's violent death and the deposition of Amurath V. (1876), the anti-Russian influence became predominant with Abdul Hamid, and events moved rapidly toward war. After the conference at Constantinople during the winter of 1876-77, Ignatieff hastened to Berlin, Vienna, and London on diplomatic business. At the close of the war he participated in the negotiations of Adrianople, and was mainly responsible for the Treaty of San Stefano. On account of disagreements with Gortchakoff, he retired from office, but on the accession of Alexander III. (1881) he was recalled and made Minister of the Imperial Domains, and then of the Interior. While holding this office he attained prominence as a persecutor of the Jews. This, as well as his opposition to M. de Giers, led to his retirement a second time, June 21, 1882. He subsequently participated in public affairs only as member of the Council of the Empire and of the Senate. He is a prominent figure in the Pan-Slavic or Nationalist Party.

IGNATIUS, Ĭg-nā′shĭ-ŭs, Saint (c.790-878). A patriarch of Constantinople, youngest son of the Emperor Michael I. In 813 the Armenian usurper Leo V. forced him to enter a cloister. From the position of abbot the Empress Theodora raised him to that of Patriarch of Constantinople (847). He had no sympathy with the iconoclasts, and so was in favor with the Empress. On the other hand, he excommunicated her brother Bardas, who made him one of his first victims when he took the reins of government for the young Michael III. (857). Ignatius refused to abdicate, until forced to do so in 866. He was reinstated on the accession of the Emperor Basil in 867. He is still a favorite saint in the Greek Church.

IGNATIUS OF ANTIOCH, Saint. Bishop of Antioch in the reign of Trajan, and author of seven Greek letters which are included among the works of the Apostolic Fathers (q.v.). Little is known of Ignatius's life. He was born probably not far from the middle of the first century. Syria appears to have been his home. Tradition says that he was a disciple of the Apostle John, which is not impossible. Much less likely is the tradition which makes him the child whom Jesus took in His arms and blessed. There is no reasonable ground for doubting that Ignatius was Bishop of Antioch, but we do not know how long he held that office. The statement of Origen and Eusebius that he was the second Bishop may be accepted. This leaves Peter out of account, and makes Ignatius the successor of Evodius. Respecting the close of his life, we have more definite information. He was condemned to be killed by wild beasts in the arena, and for that purpose was taken to Rome, under guard of ten Roman soldiers. They passed through Asia Minor, stopping here and there, and being received with Christian hospitality by the churches along their route. At Smyrna Ignatius wrote letters to the churches of Ephesus, Magnesia, Tralles, and Rome. Further on, at Troas, he wrote to the Philadelphians, the Smyrnæans, and to Polycarp, Bishop of Smyrna. He then was led to Rome, where he suffered martyrdom, probably at some time between 107 and 117 A.D. The most definite early statements point to the tenth year of Trajan, which would be 107-108. It was believed, at a considerably later time, that his remains were carried to Antioch for burial.

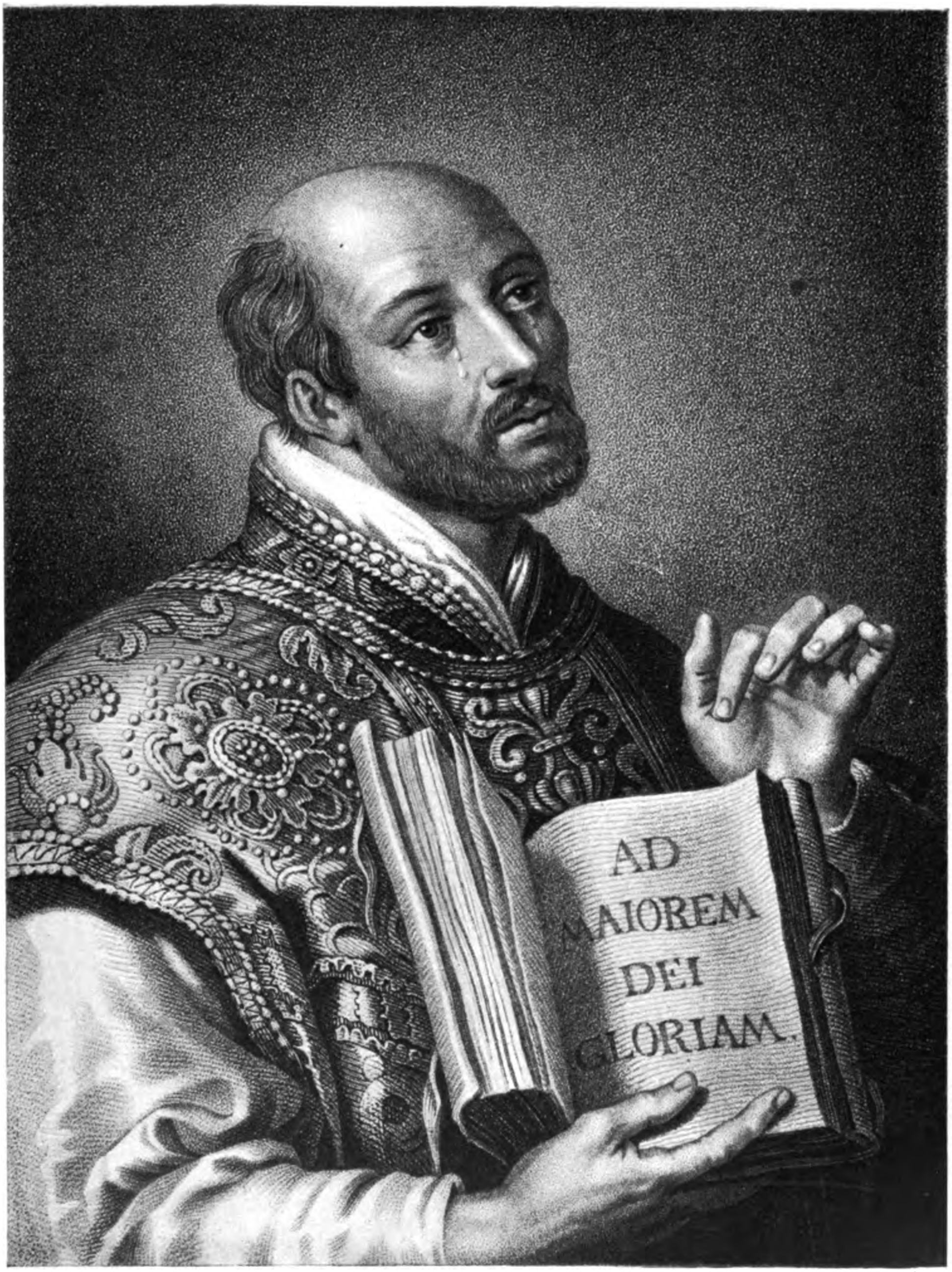
The extant *Martyr Acts* of Ignatius are not authentic. Long and bitter controversy has raged over the epistles which bear his name. They are extant in several different versions, especially three: (1) *The longer Greek*, containing thirteen epistles; (2) *the shorter Greek*, containing seven epistles; (3) *the Syriac*, containing only three epistles. The critical question is, Which form, if any, is the genuine one? Opinions have varied widely. It has been held (a) that all the recensions are spurious; (b) that the shorter Greek form alone is genuine; (c) that the Syriac alone is genuine; (d) that, of the shorter Greek form, all the epistles except Romans are genuine; and (e) that Romans only is a genuine epistle. The best modern criticism holds to the authenticity of the seven epistles in the shorter Greek form. There is almost contemporary witness borne to the Ignatian letters in the Epistle of Polycarp to the Philippians (see Polycarp).

Accepting these seven as genuine letters of Ignatius, we learn to know their author as a fervent, enthusiastic Christian bishop, of intense zeal for martyrdom. He constantly insists on maintaining allegiance and obedience to the bishop, who is the centre of unity. It is evident that the monarchical episcopate, i.e. the system of having one bishop over each church, had already been developed in Syria and other portions of the East, whatever may have been the case elsewhere. The heresy against which Ignatius warns is chiefly docetism, for he declares that Christ suffered in fact, not merely in appearance. He also warns against Judaizing heresies. From the doctrinal point of view, Ignatius is highly important, standing as he does in the line of catholic development which passes from Paul and John, through Ignatius and Irenæus, to the full-grown Nicene theology. It is in his letter to the Christians of Smyrna that we meet for the first time with the phrase 'the Catholic Church.' It does not, however, bear its later, technical sense of the exclusive orthodox Church, but its earlier, etymological meaning of 'the universal Church.' We owe to Ignatius the application of the term 'eucharist' to the Lord's Supper. But above all else, his epistles bear witness to the earnest, devoted spirit of early second-century Christianity, and to the vitality of faith in the age succeeding that of the Apostles.

For the best edition of Ignatius, consult: Lightfoot, *The Apostolic Fathers: Part II., S. Ignatius and S. Polycarp* (London, 1889), with English translation. Text and translation are also found in the small edition of Lightfoot, *Apostolic Fathers*, by Harmer (London, 1893); English translation alone in the *Ante-Nicene Fathers*, edited by Roberts and Donaldson, vol. i. (Buffalo, 1886). In general, consult: Cruttwell, *Literary History of Early Christianity* (London, 1893); Harnack, *Chronologie der altchristlichen Litteratur* (Leipzig, 1897); Von der Goltz, *Ignatius von Antiochien* (Leipzig, 1894); Smith and Wace, *Dictionary of Christian Biography*, article "Saint Ignatius."

IGNATIUS OF LOYOLA, lō-yō̆′lȧ, Saint (1491 or 1495-1556). The founder of the Jesuits. Iñigo Lopez de Recalde was the youngest of thirteen children, of a noble family. Until recently he was said to have been born on Christmas night, 1491, but the Bollandists and Polanco are authority for the change to 1495. He was born in the ancestral Castle of Loyola, near Azpeitia, in the Basque Provinces, not far from the French frontier. At fourteen, after a scanty education, he became a page at the Court of Ferdinand the Catholic. Court life grew distasteful after some years, however, and he became a soldier under his relative, the Duke of Najera, in 1517. He fought bravely against the Navarrese, the Moors, the Portuguese, and the French. He had reached the rank of captain when, while directing the defense of Pamplona against the French in the war between Francis I. and Charles V., he was wounded severely, May 20, 1521. He was taken prisoner and conveyed to the Castle of Loyola. As a result of the wound, one leg was badly deformed. This would have been very unsightly in the fashionable hose of the day, and he bade the surgeon reduce the deformity at any cost. The leg was rebroken and he bore the operation and consequent suffering without complaint. His convalescence was prolonged, and time hung heavily on his hands. He asked for some romances of knight-errantry then popular, but there were none in the castle. Instead they brought him a translation of Ludolf of Saxony's life of Christ, and some lives of the Saints. Ignatius's life as a soldier had been far from a model. Polanco says: "Up to the age of twenty-six his life had been divided between the love of women and sports, and quarrels over points of honor." For want of anything better to do, however, he read and reread these pious books. The spiritual achievements of Saint Francis and Saint Dominic came to replace the deeds of his knightly heroes in his imagination. As soon as he was able, in the garb of a beggar he went to the shrine of the Virgin at Montserrat, where after a confession of his whole life on the vigil of the Annunciation, March 24, 1522, he hung up his arms as a votive offering and a symbol of his renunciation of his military career and of his entire devotion henceforth to the spiritual warfare. Then, barefoot, he went to the neighboring town of Manresa and served the sick and poor in the hospital. He lived in a cave, and his austerity finally impaired his health, though it was at this time that his *Spiritual Exercises*, from which he drew great spiritual strength, took form in his mind. After this he went on a pilgrimage to the Holy Land, and would have stayed at Jerusalem to spread the gospel among the infidels, but was discouraged by the local authorities. He returned to Barcelona in 1524. Realizing now that to do good he must have more knowledge, he began, at the age of thirty-three, the rudiments of grammar in a public school beside boys. After two years he went to the new University of Alcalá and later to Salamanca. Because of public religious teaching with what was thought insufficient education, he incurred the censure of ecclesiastical authorities at both places. In 1528 he repaired to Paris to continue his studies. He was robbed by a companion and had to lodge in a hospital, where he did menial work for his support while attending the university. During his summer vacations he visited Spanish merchants in Antwerp, Bruges, and London so as to obtain money to continue his studies. During his student years he had no resources but the charity of the faithful. At Paris he formed, with chosen companions, a pious confraternity, out of which developed later the Society of Jesus. (See Jesuits.) Ignatius's genius for knowing men can be inferred from the fact that of his earliest companions chosen thus at the University of Paris, one became later the great Apostle of the Indies, Francis Xavier, and three, Lainez, Salmeron, and Lejay, became the leading theological advisers to the Council of Trent. One of the others, Faber, received the honors of beatification from the Church. In the crypt of the Church of the Martyrs, on Montmartre, on the Feast of the Assumption, August 15, 1534, the little band took their vows as Jesuits. At first their intention was to evangelize Palestine. They made their way to Venice for this purpose, but the war between the Christians and the Turks closed the way to the Holy Land, so they resolved to offer themselves to the Pope for any service he might assign. Paul III. received them with great kindness. The pulpits of various churches were assigned to them, and their burning discourses and saintly lives soon attracted attention. No other of them was so effective as Ignatius himself, who spoke as the plain, blunt, but intensely earnest, soldier. In 1539 Ignatius asked for Papal approbation of his Order. In spite of opposition to the erection of another religious Order in the Church, the Pope read the draft of the Constitutions, and said: "The finger of God is here." While occupied with his constantly growing society, Ignatius found much to do besides its direction and the writings of the Constitutions. Though a Spaniard, he devoted himself to the care of the Jewish converts, and secured the correction of many abuses in the treatment of those who wished to remain orthodox Jews. He founded a house for fallen women, and was not ashamed to be seen conducting them to it through the streets. He tried to prevent the occasions of their fall by providing a home for friendless girls. He established orphan asylums for boys and girls. The influence he acquired can be understood from the fact that he was able to end a dispute between the Pope and John III. of Portugal that threatened serious harm to religion at the moment, and another between the citizens of Tivoli and their ruler, Margaret of Austria.

His writings consist only of the Constitutions and rules of the Society of Jesus, his Letters, and the *Exercitia Spiritualia*. This last little book of scarcely a hundred duodecimo pages has proved one of the most influential works ever written. From the very beginning it formed the basis of the spiritual training of the Jesuits themselves, and the mold in which their retreats and missions to the people were cast. It has come to be the acknowledged model after which the missions and retreats given by most of the other religious Orders of the Roman Catholic Church are conducted. Three things



IGNATIUS LOYOLA
AFTER A PAINTING BY RUBENS

are treated of particularly in the book: the service of Jesus Christ, placed above all that the kings of the earth can offer; the discernment of spirits; and finally the choice of a state of life. It was this book that accomplished the reforms the Jesuits effected. The Constitutions of the Jesuits are entirely the expressions of Ignatius's ideas. They have been but slightly modified, never in any essential, by successive General Congregations. Great writers have called them one of the world's works of genius. It is often said that Ignatius founded the Jesuits to counteract the effects of the German Reformation, but there is good authority for believing that when Ignatius conceived the idea of his Order he had not even heard the name of Luther. Even more than a decade later, he seems to have paid little heed to the religious movements in Europe, especially in Germany. One year before his death in 1555 the society comprised eight provinces, divided as follows: Italy, two; Spain, three; Portugal, one; Brazil, one; India and Japan, one. In Germany there were but two residences—Cologne and Vienna. He died in Rome, July 31, 1556. He was beatified in 1609 and canonized in 1622.

Consult: Ribadeneira, *Vita Ignatii Loiolæ Soc. Jesu Fundatoris* (Naples, 1572; best recent edition, Barcelona, 1885), translated into most modern languages. For Ignatius's life as General of the Jesuits, his letters, *Cartas de San Ignacio de Loyola* (Madrid, 1874), are the authoritative sources of information. Ignatius dictated some autobiographical notes called the *Acta*, which must form the basis of an appreciation of the man himself. There are several English editions of this: *Autobiography of St. Ignatius* (ed. O'Conor, S. J., New York, 1900), and Rix, *The Testament of Ignatius Loyola* (Saint Louis, 1900). Of recent lives the most authoritative are: Clair, *La vie de Saint Ignace de Loyola* (Paris, 1891); in English, Stewart Rose (the Duchess of Buccleuch), *St. Ignatius of Loyola and the Early Jesuits* (New York, 1891); an excellent study of Ignatius the man, Joly, *Saint Ignatius of Loyola* (New York, 1899). In the *Monumenta Historica Societatis Jesu* (Madrid, 1894) there is a hitherto unissued life of Ignatius by Polanco, who was a close personal friend. Consult, also, Hughes, *Loyola and the Educational System of the Jesuits* (Great Educators Series, New York, 1892).

IGNATIUS'S BEAN, SAINT. See SAINT IGNATIUS'S BEAN.

IGNEOUS ROCKS (Lat. *igneus*, fiery, from *ignis*, Skt. *agni*, fire). Rocks produced as the result of solidification from a molten condition. Such rocks include lavas which have been poured out upon the earth's surface; the fillings of the fissures, pipes, and other passages in the earth's crust through which molten material was conducted during its rise to or toward the surface: and the larger masses which consolidated at great depths. The agents of decomposition and disintegration of rock material and those of transportation and degradation necessarily expose to view these several types of igneous rocks, each of which possesses certain general and distinguishing characteristics. The most noteworthy general characteristic of the igneous rocks, when unmetamorphosed, is a massive structure without lamination or bedding, such as is characteristic of the sedimentary or clastic rocks on the one hand; or schistose structure, such as is developed in the metamorphic rocks. Inasmuch, however, as it has been shown that many *metamorphic rocks* (q.v.) have been formed from igneous rocks, it is clear that no sharp line can be drawn to separate these classes on the basis of structure, although in the main the above distinction applies.

Prominent among the textures characteristic of the igneous rocks are the granitic, the porphyritic, and the vitreous or glassy. The granitic texture is crystalline throughout and consists of an interlocking mosaic of the different mineral constituents, the nearly uniform size of the grains indicating that the process of consolidation was essentially an uninterrupted one, and that practically the same conditions obtained during all stages of the process. In this mosaic the mineral constituents which first separated from the magma have more or less perfect crystal outlines, whereas those of later separation have irregular boundaries because sufficient space was not available in which to build out their crystal faces. The porphyritic texture, which is the next most common among the igneous rocks, has crystals of one or more of the mineral constituents of the rock imbedded in a base or ground mass of smaller crystals, or of rock glass. The crystals imbedded in the ground mass are known as porphyritic crystals or phenocrysts. It is generally supposed that the phenocrysts were crystallized out of the magma in a stage of the process of consolidation earlier than that which produced the ground mass of the rock, and as most igneous rocks of porphyritic texture have been formed either at the surface of the earth or at quite moderate depths below it, it is supposed that the phenocrysts were formed at considerable depths before the magma rose to or near the surface. In the lavas that flow from Vesuvius, or from most other volcanoes, the phenocrysts may be picked out of the still molten lava as it flows from the volcano. The vitreous or glassy texture is one of comparatively infrequent occurrence, but is represented by obsidian (q.v.) and pitchstone. It is now generally recognized that many igneous rocks which have an entirely crystalline texture were once largely composed of rock glass, which has devitrified through processes of chemical alteration and crystallization.

In addition to the above textures characteristic of igneous rocks and dependent upon the state of crystallization of the rock substance, there are many others. One of the most common observed in lava (q.v.) is a peculiar crumpled lamination of the rock caused by the arrangement of mineral constituents of unequal dimensions with their longer axes parallel to the crumpled lines of the texture. This fluxion texture is conditioned by the flow of the lava, the crumpled lines indicating the direction of flow. Other textures, as the amygdaloidal, scoriaceous, and pumiceous, which indicate different grades of cellular or porous texture, are conditioned by the steam once held in the lava and the opportunities for expansion and escape of this steam as the lava approached the surface of the earth.

In chemical composition the igneous rocks show wide variation, though limits are set by the laws of formation of magmas. No such limits are set for the clastic rocks. By processes of alteration the igneous rocks change into the metamorphic rocks (as do also the clastic rocks), so that no sharp line can be drawn to separate these great divisions.

Great difficulties arise in the systematic classification of igneous rocks, by reason of the many ways in which it is possible to describe them, and the varying importance which is attached to each method; hence great difference of opinion exists among petrographers as to the best scheme to be adopted. On the Continent of Europe, and especially in Germany, the manner of occurrence of a rock, whether as a boss or batholite (q.v.), as a dike (q.v.), or as a sheet or flow, is given the first importance; and the age of the rock, once considered paramount, still retains its importance in the secondary classification. In America opinion seems to favor as bases of classification the chemical composition, the texture, and the mineral composition; but the future must be awaited before any classification free from serious objections is likely to be adopted. The almost hopeless confusion of the schemes now in use is generally recognized. The reader is referred to the following works, in which are given detailed descriptions of igneous rocks. Consult: Kemp, *Handbook of Rocks* (New York, 1896); Rosenbusch, *Mikroskopische Physiographie der Mineralien und Gesteine* (Stuttgart, 1896); Zirkel, *Lehrbuch der Petrographie* (Leipzig, 1894); Teall, *British Petrography* (London, 1888). See GEOLOGY.

IG'NIS FATUUS, făt'ū-ŭs (Lat., vain fire). A luminous appearance frequently seen in marshy places, in churchyards, and over stagnant pools. It generally appears a little after sunset as a pale, bluish-colored flame, varying in size and shape; sometimes it shines steadily till morning, at other times disappears, and reappears within about half-hourly intervals. It floats in air at about two feet from the ground, is sometimes fixed, and sometimes travels with great rapidity. Many efforts have been made to discover its cause; but so varied are its appearances and so void of any common principle, that these attempts have totally failed. Two of the various explanations offered may be mentioned here. The first is that the ignis fatuus is due to phosphureted hydrogen gas (PH_3), which possesses the property of igniting when it comes in contact with dry atmospheric air; the gas would be generated by the decomposition of animal matter present in a marshy soil. The second is that it is due to the combustion of methane, or marsh-gas, CH_4, produced by the decomposition of vegetable matter; but though this supposition satisfactorily accounts for many appearances connected with the ignis fatuus, the gas itself is not spontaneously combustible, and an additional supposition becomes necessary to account for its ignition. The probable conclusion is that a number of phenomena, apparently similar, but arising from different causes, are aggregated under the term ignis fatuus.

The appearance of ignis fatuus is not a common phenomenon, and many distinguished naturalists who desired to investigate it have never succeeded in finding it; but it is not unfrequently seen in the north of Germany, the swamp and moorland districts in the south and northwest of England, and in the lowlands of Scotland. It is seen in the above places from the middle of autumn till the beginning of November. In former times the ignis fatuus, under the names of Will-o'-the-Wisp, Jack-a-lantern, Spunkie, etc., was an object of superstition among the inhabitants of the districts where it appears, and was believed to be due to the agency of evil spirits attempting to lure travelers to their destruction.

IGNORANCE OF THE LAW. One of the important maxims of the common law is *ignorance of the law excuses no one.* It is not, however, an aphorism of universal application, nor is it to be pressed into the service of injustice; neither does it warrant the presumption that every one knows the law. There is no such presumption. It would be contrary to common sense and reason. Yet the rule that ignorance of law shall not serve as an excuse for illegal acts or omissions is common to all systems of law, and is not only expedient, but necessary.

The maxim is of prime importance in criminal law, yet here it has real or apparent exceptions. If a person is indicted for larceny he may show that he honestly believed the property to be his own, although it appeared that this belief was due to his ignorance of a rule of law which vested the property in another. This results, however, from the fact that he does not commit the crime of larceny unless he intended to appropriate another person's property to his own use. Had the indicted person been sued for conversion by the true owner, his ignorance of the law would have been no excuse. In the civil action for conversion his motive, or intention, or belief in taking would be immaterial. One who takes and uses property as his own acts at his peril. So if a person enters into an honest and fair contract he cannot, except in certain cases of fraud or deceit (q.v.), absolve himself from its obligation by showing that he would not thus have contracted had he known the rule of law applicable to the transaction.

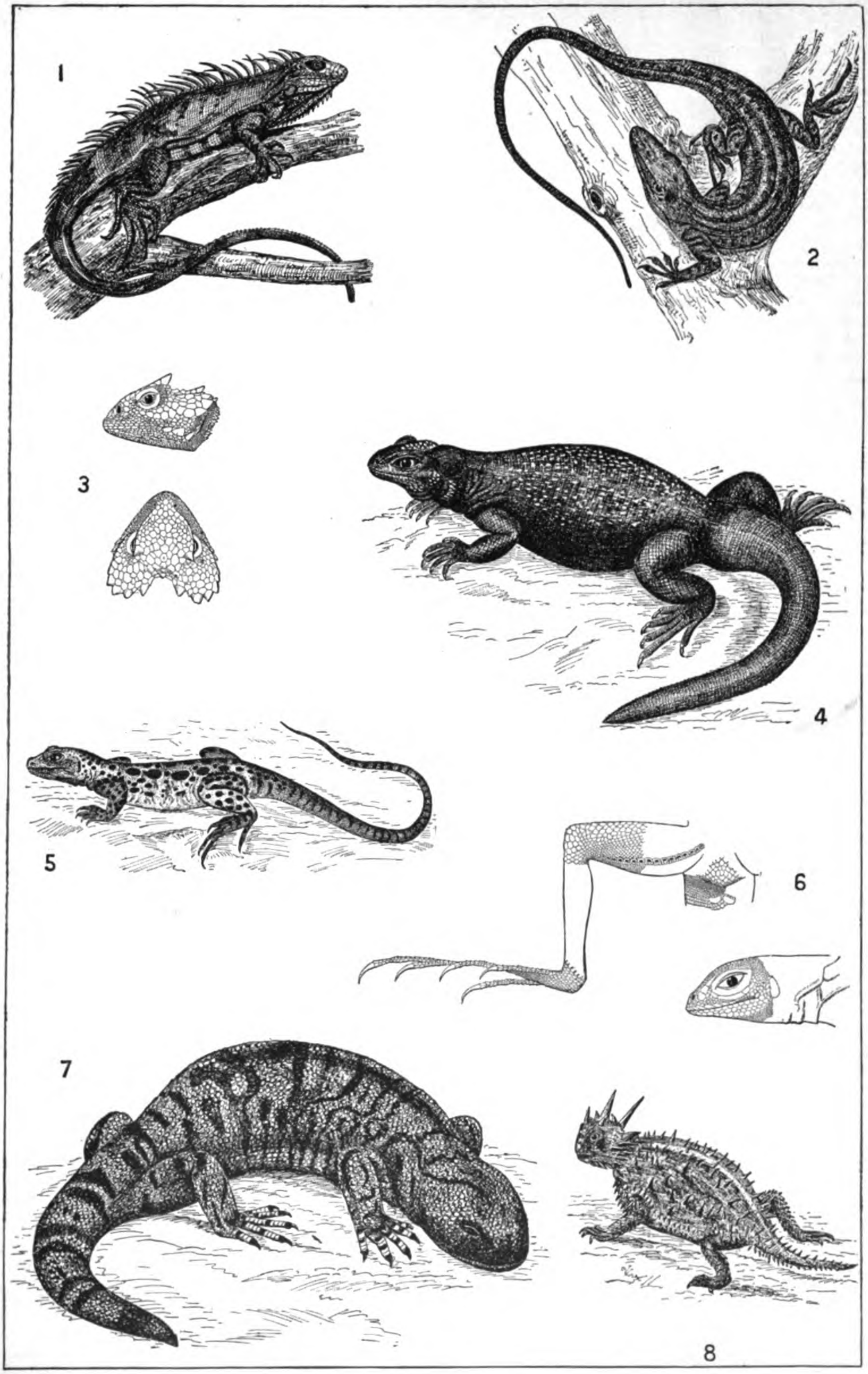
In general it may also be said that a person who has paid money in ignorance of the law cannot recover it in a quasi-contract action. This means that no man will be permitted to exempt himself from a duty, or shelter himself from the consequences of infringing a prohibition imposed by law, or acquire an advantage in opposition to the legal rights and interests of another by pretending error or ignorance of law. See MISTAKE; QUASI-CONTRACT.

IG'NORAN'TINES (from Lat. *ignorare,* to be ignorant). A religious congregation of men in the Roman Catholic Church, associated for the gratuitous instruction of poor children in sacred as well as secular learning. See SCHOOLS, BROTHERS OF THE CHRISTIAN.

IGORROTE, ē'gôr-rō'tā. A warlike people of mixed Malay-Mongoloid blood, speaking several dialects: chiefly in Benguet Province, Luzon. Also any wild Filipinos of Malay blood. Variants, Ygolot, Ygulut, etc. See PHILIPPINE ISLANDS.

IGOR'S (ē'gôrz) **BAND,** SONG OF (Russ. *Slovo o polku Igorevě*). The only Russian poetical monument, dating from the twelfth century. It recites the unfortunate outcome of the expedition (1185) of Igor, Prince of Novgorod-Syeversk, into the country of the Polovtsy in Southern Russia. The Prince was defeated and taken prisoner, but later he escaped with the help of a slave. The poetic gems of the song are the lyric passages depicting the grief of Nature over the Prince's capture; the lament of Yaroslavona, his

IGUANAS AND OTHER AMERICAN LIZARDS



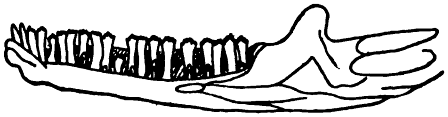
1. IGUANA (Iguana tuberculata).
2. GREEN LIZARD (Anolis principalis).
3. NORTHERN HORNED TOAD (Phyrnosoma Douglassi); top of head and profile.
4. CHUCKWALLA (Sauromalus ater).
5. LEOPARD LIZARD (Crotaphytus Wislizeni).
6. DESERT LIZARD (Callisaurus draconoides); head and hind limb.
7. GILA MONSTER (Heloderma horridum).
8. COMMON HORNED TOAD (Phrynosoma cornutum).

consort, on hearing of his fate; and the escape of Igor. The original manuscript, discovered by Musin-Pushkin and published in 1800, was destroyed in the Moscow fire of 1812. The editing was very poor, and another copy found in 1864 among Catharine II.'s papers is hardly more satisfactory. It has been an object of bitter controversy, and a vast literature on the subject has grown up. A translation by Wolfsohn in *Schönwissenschaftliche Litteratur der Russen* (Leipzig, 1843), and one with introduction and notes by Paucker (Berlin, 1884), are very good.

IGRAINE, ė-grān′. See IGERNA.

IGUALADA, ē′gwȧ-lä′Dȧ. A city in the Province of Barcelona, Spain, situated on the river Noya, in a mountainous but fertile district, 46 miles by rail northwest of Barcelona (Map: Spain, F 2). It was formerly a fortified town, but its walls are now in ruins. It has manufactures of cotton, linen, and other textiles. Population, in 1900, 10,476.

IGUANA, ĭg-wä′nȧ (Sp., from the Haitian name, *igoana*, *hiuana*, *yuana*). A genus of tropical American lizards, representing the family Iguanidæ, of which there are about 55 genera and 235 or more species. In external and internal structure iguanas closely resemble the Agamidæ of the Old World and are distinguished mainly by the pleurodont dentition. The tongue is thick and villous. All the North American forms possess femoral pores, but few of the South American species have them. In habits also the Iguanidæ closely resemble the Agamidæ, save that there are no flying forms to correspond with the flying dragon of the Agamidæ, while in America some of the iguanas, such as Anolis, have digital expansions, and others are semi-marine, neither of which conditions is met with in the Old World family. The family contains several of the largest lizards. Most of the species are arboreal, but some of them live on the surface of the sand and stones of the desert, and have a depressed form. Several species live wholly, or almost wholly, on vegetable food—the blossoms and leaves of plants. For this reason the flesh of several of them, especially of the genus Iguana, is very palatable, is sought by the natives of Central and South America as food, and is sold in their markets in considerable quantity. One of the species most eaten is *Iguana tuberculata*, a repulsive looking lizard, with a high, dorsal, fringed ridge, and a large dewlap (see Plate). It basks on the limbs of trees during the warm hours, and while thus situated seems rather indifferent to the approach of man. It is fond of music, and of having the body stroked. The natives take advantage of these facts, and whistle a lively tune as they approach, and when near enough stroke the sides of the iguana with a stick until they succeed in getting a noose over its head. (Consult Belt, *Naturalist in Nicaragua*, London, 1888.) The natives also dig them out of their burrows or chase them into trees with dogs trained for the purpose. On the Galapagos Islands there is a semi-aquatic genus, Amblyrhynchus, whose species feed on seaweeds along shore. This lizard is described in detail by Darwin, in chapter 5 of his *Naturalist's Voyage* (London, 1860). There are other species of the same genus that live for months without water by feeding on the succulent cactus. The great iguana of Jamaica, with the prominent serrate crest, is *Cyclura lophoma*. In the Southwestern United States, from western Kansas to southern California and Mexico, dwell several genera of green, dark gray, or brown iguanid lizards, such as Uta, Holbrookia (q.v.), Ctenosaura, and Crotaphytus. (See COLLARED LIZARD.) The large genus Sceloporus (see ALLIGATOR LIZARD) ranges not only over the western and central part of the United States, but in all the Eastern and Gulf States as far north as New Jersey and Indiana. Another widely distributed genus, Anolis, has two representatives in the South Atlantic States, popularly called 'chameleons.' (See ANOLIS.) These lizards possess mimicry of color in a remarkable degree, and have a considerable power of changing their color. They are insectivorous, and the wanton destruction of them is much to be deplored, for in their native habitats they are of considerable economic importance to agriculture. To this family belongs also the basilisk of Central and South America, so named on account of its fancied resemblance to the creature of fable. (See BASILISK.) It is a large, harmless lizard, found no further north than Southern Mexico. The family also includes those peculiar, spiny, short-tailed, flattened lizards, known as 'horned toads' (q.v.).



TEETH OF AN IGUANA.

Consult: Boulenger, *Catalogue of Lizards of the British Museum* (London, 1885); Cope, *Crocodilians, Lizards, and Snakes* (Smithsonian Institution, Washington, 1900); Stejneger, *Death Valley Expedition* (Department of Agriculture, Washington, 1893); Kingsley (editor), *Standard Natural History*, vol. iii. (Boston, 1885); Gadow, *Amphibia and Reptiles* (New York, 1901). See LIZARD.

IGUANODON, ĭg-wăn′ō-dŏn (Neo-Lat, from Eng. *iguana* + Gk. *ὀδούς*, *odous*, tooth). A genus of ornithopod dinosaurs, found fossil in Jurassic and Lower Cretaceous rocks of Europe. Iguanodon is perhaps the first dinosaur brought to light, for it was described by Mantell in 1825 from specimens found in Kent, England. The animal was 15 to 25 feet long; the head was large and narrow, the jaws heavy and furnished with numerous teeth of peculiar form that resemble those of the modern American lizard iguana. The anterior portions of the jaws are provided with strong, horny beaks like those of turtles. The fore limbs have four toes and a 'spur,' and are much shorter than the heavy three-toed hind limbs. The pelvis is elongated, and the tail heavy, and there is a ridge of strong vertebral spines extending along the dorsal surface from the neck to the middle of the tail. All the bones are hollow. Iguanodon was an herbivorous dinosaur that walked on its hind legs, and sat on a tripod formed by the hind legs and tail, after the manner of the kangaroo. It lived in great numbers in the swampy regions of England and Belgium, and other parts of Europe during Jurassic time, as indicated by the mode of occurrence of its fossil skeletons, twenty-nine of which were found at one time in Upper Jurassic sandstones of the coal regions at Bernissart, Belgium.

Iguanodon has not been found in the Mesozoics of America, where it is represented by similar genera Camptosaurus, Laosaurus, and Thespesius. A very instructive account of the discovery and early history of Iguanodon, illustrating the method by which fragmentary material has after careful work yielded valuable results, is to be found in Mantell's *Petrifactions and Their Teachings* (London, 1851). See also Woodward, *Outlines of Vertebrate Palæontology for Students of Zoölogy* (Cambridge, 1898). See Camptosaurus; Dinosauria.

IHLANG-IHLANG, ė-läng′-ė-läng′ (Malay, flower of flowers). A strong and rich perfume from a Malayan tree (*Cananga odorata*) of the custard-apple family (*Anoneæ*). The perfume is distilled from a volatile oil yielded by the flowers.

I. H. N. CLUBS. See Lend-a-Hand Clubs.

IHNE, ē′ne, Wilhelm (1821-1902). A German historian, born at Fürth, and educated at Bonn (1839-43). He was private tutor in England (1843-47), and returned to Liverpool, where he had charge of a school (1849-63), after two years' teaching at Elberfeld. In 1863 he went to Heidelberg, where he was made professor in 1873. He wrote: *Quæstiones Terentianæ* (1843); *Researches into the History of the Roman Constitution* (1853); *Plea for the Emperor Tiberius* (1856); a *History of Rome* (1871-82), of which the German edition was published later, and is partly the work of Zumpt, and *Early Rome* (1876).

IHRE, ē′re, Johan (1707-80). A Swedish scholar of Scottish extraction. He was born at Lund, and educated at the University of Upsala, where he acquired a great reputation, and carried off the highest honors. He subsequently traveled in France and England, was appointed under-librarian to the Academy of Sciences on his return to Sweden, and rose through a variety of offices to be professor of belles-lettres and political economy (1748). Ihre's principal work is his *Glossarium Suiogothicum* (1769), which may be regarded as the foundation of Swedish philology. It was published at the cost of the State, which gave Ihre $10,000 to execute it. His numerous academical disputations, amounting to upward of 450, are still valuable, especially those on the Mœso-Gothic version of the Gospels by Ulfilas.

I. H. S. See Abbreviations.

II KAMON NO KAMI, ē-ē kä′mōn nō kä′mē, or Ii Naosuké, Baron (1815-61). The Japanese statesman whose wise and vigorous statesmanship led to the opening of Japan to foreign nations, and the establishment of friendly relations with them. He was the fourteenth son of Baron Ii, of Hikone on Lake Biwa, and was born of a line of ancestors known honorably in the tenth century. At twenty-one, Ii went to Yedo, and had his mansion within the inclosure of Yedo Castle at Sakurada, or Cherry Field. In 1850 he was made heir to the baronetcy, assuming the highly honorable title of Kamon no Kami, which gave him standing at the Mikado's court. In 1853 the question of foreign intercourse, precipitated by Commodore Perry, divided the opinions of the daimios. Although he shared with many a feeling of hatred toward foreigners, Ii drew a line of distinction between personal feelings and national interests, and declared himself to be in favor of intercourse with foreigners, and of a revival of the military spirit for national defense. The Shogun Iycsada being childless and in poor health, the question of appointing an heir added to the complication of the period. Pressed by Townsend Harris (q.v.) to sign the treaty which he had negotiated, and which the Court in Kioto opposed, the Shogun had to face a crisis which admitted of no delay. On June 4, 1858, two days after the Mikado's refusal to approve the treaty, the Shogun appointed Ii to be Tairo or Regent, and on the 5th he was publicly installed, as the virtual ruler of Japan, but acting in the name of the Shogun. The Shogun Iycsada died suddenly August 15th, leaving no heirs. Carrying out his master's wishes, Ii appointed Kikuchiyo, who subsequently took the name of Iyémochi, the Prince of Kishiu, then a child of twelve, to be his successor, and, taking the responsibility, in view of the rapid approach of the squadrons of the Russians, British, and French after their victorious campaign in China, he signed the liberal treaty drawn up by the United States Minister. The treaty with Great Britain followed on August 26th and that with France on October 9th.

The great daimios of Mito, Owari, and Echizen, however, opposed his nominee to the shogunate, the two former daimios wishing also to have Echizen made regent. On the outbreak of the long-gathering storm of opposition, Ii crushed his enemies with a strong hand, and dispatched an embassy to the United States to ratify the treaty. Among other triumphs he had the Princess Kazu, aunt of the present Emperor, betrothed in marriage to the young Shogun, and they were married in Yedo in 1861. Before this, on the 23d of March, 1861, a snowy day, while on his way in his palanquin with a large following of bodyguards to the palace in Yedo, they were attacked by a band of eighteen assassins, seventeen from Mito, one from Satsuma, all of them Ronins. In the fight which ensued Baron Ii himself was stabbed, and his head cut off and carried away to the castle town of Mito, and there exposed on a pole. For years the name Ii rested under a cloud, but it has been cleansed by Shimada Saburo in his book *Kai Koku Shimatsŭ* ("Opening of the Country, Beginning and End"), which has been translated into English under the title of *Agitated Japan* (1896). The man and the episode of his assassination have given rise to a considerable body of native literature, and the episode is treated in fiction by A. C. Maclay in *Mito Yashiki* (3d ed., 1899).

IIWI, ē-ē′vē. The English spelling by many voyagers of the name of a Hawaiian bird, otherwise known as 'mamo' (q.v.), whose scarlet plumage was used for the native feather cloaks.

IKAO, ė-kä′ō. A famous summer resort of Japan, situated in the Province of Katsuke, about 20 miles by rail from Takasaki, and 88 miles from Tokio. It is built on the slopes of the Haruna Mountain, and is celebrated for the picturesqueness of its situation as much as for its two hot springs and rich vegetation. The mineral springs have a temperature of 113° F., and contain iron and sulphate of soda.

IK MAR′VEL. See Mitchell, Donald Grant.

IKUNO, ė-kōō′nō. A mining town of Japan, situated at an altitude of 1200 feet, in the prefecture of Hiogo, about 35 miles northwest of Kobe, and 31 miles by rail from Himeji. Its silver-mines, the second largest in Japan, are run by the Government. Over 1500 persons are employed, and the mines are worked day and night. Besides silver they also yield gold. Population, estimated at 3000.

ILAGAN, ē-lä'gän. The capital of the Province of Isabela in Luzon, Philippines (Map: Philippine Islands, F 2). It is situated in the centre of the province at the confluence of several streams, about 330 miles northeast of Manila. Its tobacco industry is important. Population, in 1898, over 13,800.

ILANO, ē-lä'nō, or **ILLANO**. A Moro tribe on Illano Bay, Southern Mindanao. See PHILIPPINE ISLANDS.

ILCHI, ēl'chē'. A city of the Chinese Empire. See KHOTAN.

ÎLE-DE-FRANCE, ēl-de-fräɴs. The former name of Mauritius (q.v.), an island in the Indian Ocean.

ÎLE-DE-FRANCE. One of the old provinces of France, having Paris as its capital, and now mostly comprised in the departments of Seine, Seine-et-Oise, Seine-et-Marne, Aisne, and Oise. During the last century of the Carolingian dynasty, the Ile-de-France was possessed by a race of powerful nobles who took the title of Dukes of France. One of the ablest of these was Hugo or Hugues, surnamed Le Blanc, or Le Grand, who for twenty years previous to his death (956) virtually wielded the sovereign power under the Carolingian kings Louis IV. and Lothair. His son Hugh Capet eventually became the actual sovereign. See CAPETIAN DYNASTY.

ILEO-CÆCAL (ĭl'ē-ō-sē'kal) **VALVE**. A valvular constriction that guards the passage between the large and the small intestine, at the opening of the cæcum. It consists of a double fold of mucous membrane, and is present in all mammals except certain carnivora.

IL'EUM. See INTESTINE.

IL'EUS (Neo-Lat., from Lat. *ileos*, Gk. *εἰλεός*, *eileos*, *ἰλεός*, *ileos*, severe colic, from *εἰλεῖν*, *eilein*, to roll up; connected with Lat. *volvere*, to roll, Eng. *wallow*). A severe colic, due to intestinal obstruction. Its symptoms are pain, nausea, and vomiting—which latter may contain feculent matter—rapid and feeble heart, and collapse. The obstruction may relieve itself, or if of mechanical origin, it may require operative interference to save life.

Ī'LEX (Lat., holm-oak). A tree often named in the Latin classics, the evergreen oak or holm-oak (*Quercus Ilex*). It is a native of most parts of the south of Europe, and of the north of Africa, and often attains large dimensions. Its leaves are ovate-oblong, acute, leathery, hoary beneath; but they vary much in some respects, from the size of a sloe-leaf to that of a beech, and from being very spiny at the edge to perfect evenness. Its wood is very hard and heavy, tough, durable, and useful, particularly for axles, pulleys, screws, and whatever is to be subjected to much friction. The acorns are of various quality, sometimes bitter, and sometimes sweet and eatable. In modern botany Ilex is the generic name of the holly (q.v.).

ILFORD, ĭl'fērd. A town in Essex, England, five miles southwest of Romford (Map: London, D 9). Its modern growth and importance are due to the photographic industry, the establishment of dry-plate works, and a paper-mill. The erection also of the London County Council's Claybury Hall Lunatic Asylum, holding 2000 persons, has been instrumental in adding to the population. The twelfth-century chapel of a mediæval hospital is of archæological interest. The British Museum contains fossil remains of mammoths discovered here. Population, in 1891, 10,900; in 1901, 41,250.

ILFRACOMBE, ĭl'frȧ-ko͞om. A market-town, seaport, and watering-place on the north coast of Devon, England, finely situated amid picturesque irregular hills, on an inlet of the British Channel, 11 miles northwest of Barnstaple (Map: England, B 5). The harbor is formed by ramparts of rock, and furnished with a lighthouse and a pier. It has excellent bathing facilities which, with its fine air, make it a popular summer resort. Fishing and an active coasting trade are carried on. It is an old town, and in the fourteenth century was of considerable commercial importance. Population, in 1891, 7692; in 1901, 8600.

ILGEN, ĕl'gen, KARL DAVID (1763-1834). A German philologist and educator, born at Burgholzhausen in Saxony, and educated at Leipzig. In 1789 he became rector of the gymnasium at Naumburg; in 1794 professor of Oriental languages at Jena; and in 1802 rector of the Landesschule at Pforta, where he labored with conspicuous success for nearly thirty years. His main works are: *De Jobi Natura atque Virtutibus* (1788): *Urkunden des ersten Buches Mosis in ihrer Urgestalt* (1798); *Die Geschichte Tobis nach drei verschiedenen Originalen übersetzt* (1800); *Hymni Homerici* (1796); *Scolia Græcorum* (1798); *Opuscula Varia Philologica* (1797); and *Animadversiones ad Vergilii Copam* (1820). Consult Naumann, *Ilgeniana* (Leipzig, 1853).

ILI, ē'lē'. A river which rises, under the name of Tekes, in the Thian-Shan Mountains, on the borders of the Russian and Chinese empires, not far from Lake Issyk-kul, flows at first in a northeasterly and then in a westerly direction, passing the town of Kuldja, and falls into Lake Balkhash in the Russian Central Asiatic Province of Semirietchensk (Map: Asia, G 4). It is about 800 miles long, and is navigable from Kuldja.

IL'IAC ARTERIES. The two arteries formed by the bifurcation of the abdominal aorta. The aorta (q.v.) divides at its lowest point—which is usually on the left side of the body of the fourth lumbar vertebra—into the two common iliac arteries, which pass downward and outward on each side to the margin of the pelvis for about two and one-half inches, and then divide into the external and internal iliac artery of either side. The external iliac passes obliquely downward and outward to the femoral arch, when it enters the thigh and becomes the femoral artery. The internal iliac is a short vessel, about an inch and a half in length, which divides into an anterior and a posterior trunk. The anterior trunk divides into several branches, which supply the bladder, the rectum, the generative organs, and muscles both within and on the outside of the pelvis, with arterial blood; while the branches of the posterior trunk mainly supply muscles within and on the outside of the pelvis. The importance of the internal iliac artery in carrying on the circulation in uterine life is noticed in the article FŒTUS.

IL′IAD. See HOMER.

ILIAD OF FRANCE, THE. A name sometimes given to the *Roman de la Rose.*

ILION, ĭl′ĭ-ŏn. A village in Herkimer County, N. Y., 12 miles east-southeast of Utica; on the Mohawk River, the Erie Canal, and the New York Central and Hudson River and the West Shore railroads (Map: New York, E 2). It has a fine public library, with about 11,000 volumes. The manufactures include firearms, typewriters, bicycles, knit goods, and cabinet and filing cases. The water-works and electric-light plants are owned by the municipality. One or two families seem to have moved to the site of Ilion about 1816, but there was properly no village here until about 1828. It was incorporated in 1852. Population, in 1890, 4057; in 1900, 5138.

ILI′ONA (Lat., from Gk. Ἰλιόνη, *Ilionē*). In Greek mythology the wife of Polymnestor, King of Thrace. She was the daughter of Priam and Hecuba, and according to one legend brought up her brother Polydorus, who had been committed to the care of Polymnestor. When the latter, instigated by the Greeks, who wished to exterminate the race of Priam, designed the murder of Polydorus, Iliona substituted his own son, Deipilus, who was put to death instead.

ILI′ONEUS (Lat., from Gk. Ἰλιονεύς). The son of Niobe, killed with all her other children. He was praying, and Apollo would have saved him if the arrow had not already been sent.

ILITHYIA, ĭl′ĭ-thī′yȧ (Lat., from Gk. Εἰλείθυια, *Eileithyia*). The Greek goddess who presided over childbirth. The plural form Ilithyiæ is used in the *Iliad,* but elsewhere only one goddess of the name is mentioned.

IL′IUM. See TROY.

ILIUM (Lat., flank). A portion of one of the bones of the pelvis, the os innominatum. In the undeveloped child it is a distinct portion, which afterwards becomes united to the pubis in front and to the ischium behind and below. It is the hip-bone or haunch-bone. See PELVIS.

ILKESTON, ĭl′kĕs-tŏn. A market-town in Derbyshire, England, 10 miles northeast of Derby, on an eminence in the valley of Erewash (Map: England, E 4). There are manufactures of hosiery and lace, and coal and iron works in the vicinity. The town possesses a valuable medicinal mineral spring and baths. It was known in 1084 as Tilchestune. It obtained a grant for a market and fair in 1251, but was not incorporated before 1887. It owns its gas, water, markets, and cemetery, and maintains a sewage farm. Population, in 1891, 19,744; in 1901, 25,400.

ILKHANS, ēl-känz′. See MONGOL DYNASTIES.

ILLÆ′NUS (Neo-Lat., from Gk. εἰλεῖν, *eilein,* to roll closely). A fossil trilobite with smooth-surfaced elliptical or rounded carapace, found in the Ordovician and Silurian rocks of most parts of the world. See TRILOBITA.

ILLAMPU, ē-lyäm′pōō. A mountain of the Andes. See SORATA.

ILLA-TICSI, ē′lyȧ tēk′sē (Quichua, Eternal Light). A name given to the supreme god of the Peruvians, Uiracocha.

ILLE-ET-VILAINE, ēl′ā′vē′lān′. A maritime department in the northwest of France, a portion of the old Province of Brittany, lying between the English Channel and the Department of Loire-Inférieure (Map: France, E 3). Area, 2699 square miles. Population, in 1896, 622,039; in 1901, 613,567. It is watered chiefly by the rivers from which it derives its name—the Vilaine, and its tributary, the Ille. The usual grain crops are raised in sufficient quantity to meet the wants of the population. Flax and hemp are extensively produced, and the cider of this district is esteemed the best produced in the country. Cattle are reared in great numbers, iron-mines are worked, and great varieties of linen and woolen fabrics are manufactured. Rennes is the capital, and Saint-Malo the principal seaport.

ILLEGITIMACY (from Lat. *in-,* not + *legitimus,* legal, from *lex,* law). According to the civil and statute law as found in many States, the status of children born out of wedlock. In England, children born out of wedlock have been held as illegitimate even upon subsequent intermarriage of the parents; also children of the deceased wife's sister have long been considered illegitimate. In Italy, much confusion has arisen as to legitimacy, owing to the strife between Church and State. It has been held that children resulting from marriages which had been solemnized by the Church only were illegitimate, a civil marriage being necessary to give legitimacy to offspring.

In New York the children of a man and woman cohabiting professedly as husband and wife have been held to be legitimate. In France, where informal unions are common, the same rule does not hold. Children of such a union are considered illegitimate. A great variety exists as to theory and practice in different lands, and reference must be made to special treatises on the subject. Illegitimacy has been much discussed from three distinct points of view—the moral, the economic, and the legal.

COUNTRY	1897		1898		1899		1900		
	Total births	Illegitimate	Total births	Illegitimate	Total births	Illegitimate	Total births	Illegitimate	Per ct. illegitimate, 1900
England and Wales	921,693	38,409	923,165	38,333	928,646	37.124	926,304	36,814	4.00
Ireland	106,664	2,802	105,457	2,873	103,900	2,674	101,459	2,702	2.7
Scotland	128,877	8,068	130,861	8,870	130,656	8,448	131,855	8,503	6.5
Germany	1,991,126	184,084	2,029,890	185,220	2,045,286	183,504	....	....	(1899) 8.9
France	859,107	75,989	843,933	74,586	847,627	74,970	827,297	73,121	8.8
Belgium	190,987	15,885	190,921	15,052	194,268	14,919	....	....	(1899) 7.68
Italy	1,101,848	70,199	1,070.074	67,262	1,068,558	67,262	1,067,376	68,406	6.00
Holland	161,441	4,407	160,765	4.205	163,289	4,290	162,611	4,247	2.6
Sweden	132,999	14,933	136,523	15,641					

For the student of morals and social reformer the causes and effects of illegitimacy form the leading points of observation. That the number of illegitimates justifies consideration, the preceding statistics on the general situation may give sufficient evidence.*

Of all subjects for statistical investigation, illegitimacy presents perhaps the most difficulties, owing to the lack of agreement among different legal authorities as to what constitutes illegitimacy, and to the fact that it is a phenomenon naturally subject to concealment. Complete figures up to date cannot be secured; it appears, however, that in civilized lands children born out of wedlock vary from 3 per cent. to 12 per cent. of all births. In most cases figures on illegitimacy exclude still-births. Of the latter the number equals about one-third of the illegitimates.

Attempts have been made to demonstrate statistically the causes of illegitimacy, but with little success. The study, for instance, of the fecundity of women throws very little light upon it. In Russia, in 1896, the number of births to 10 marriages was 65, while the number of illegitimates was only 31 to 1000 births. During the same period in France there were only 27 births to 10 marriages, with 88 illegitimate births per 1000. In Austria there were 44 births to 10 marriages, and 145 illegitimates per 1000 births, and England showed about 36 births to 10 marriages and 42 illegitimates to 1000. It seems evident that the apparent strong tendency to child-bearing cannot explain the phenomenon.

Equally uncertain is evidence gathered to show that climatic conditions have any large part to play. The following table (for 1896) presents some figures bearing upon the geographic distribution of illegitimacy. The division of cities is roughly made, those in the first column being north of latitude 52° N. and those in the second column south of latitude 49°:

ILLEGITIMATES PER 1000 BIRTHS

NORTHERN		SOUTHERN	
Rotterdam	70	Naples	86
Hamburg	138	Venice	189
Berlin	154	Milan	204
Saint Petersburg	276	Paris	268
Copenhagen	279	Rome	194
Stockholm	396	Vienna	449

As is seen by the table, the difference is scarcely worth considering. It certainly does not corroborate the view that the southern cities are less moral than the northern.

That the degree of illiteracy must exert some influence on the rate of illegitimate births can, perhaps, not be wholly denied. That its influence has been much overestimated seems equally certain. Along with any such general cause must be placed many other factors which complicate the problem. The table in the next column will illustrate this point.

It has long been believed that the moral conditions of the cities are lower than those of rural districts. Increased knowledge of rural conditions has tended to qualify this view. In general, it may be said that the rate of illegitimacy is higher in cities than in the country. This is due to a variety of causes. There is in the city less social restraint, less danger of detection of paternity, and a greater degree of abandonment on the part of the females. In some instances, however, as in Bavaria and in some other Continental countries, the greater freedom of marriage laws and better industrial opportunities in the city render family life more convenient and irregular relations less common than in country districts, where the conditions of holdings hinder marriages. The high degree of illegitimacy is often an indication of certain laws which affect the situation, as, for example, was the case in Bavaria. In former times the laws were extremely unfavorable to marriage, and a high rate of illegitimacy resulted. The rate of illegitimacy was as follows: 1865-69, 20.59 per cent.; 1871-80, 12.86 per cent.; 1887-91, 14.01 per cent. With the passing of more liberal marriage laws and the use of greater industrial freedom the number of marriages rapidly rose, and a corresponding fall in the number of illegitimates took place. The number of marriages increased in the period from 1840-70 from 65 per 10,000 population to 81 per 10,000 population; at the same time the rate of illegitimacy fell from 20.59 per 100 births to 12.86 per 100.

COUNTRY	Per cent. of literates in population	Illegitimates to 1000
England	96	40
Scotland	97	65
Ireland	85	27
France	95	88
Germany	99	89
Scandinavia	99	Sweden 107 Norway 71
Belgium	87	87
Russia	38	31
Austria	76	145
Italy	62	77

Laws instituting an inquiry as to parentage have so far had little effect in checking illegitimacy. The following table will serve to illustrate this feature of the case:

RATE PER 1000 CHILDREN BORN, PERIOD 1878-82.
STILL-BIRTHS EXCLUDED

Countries where inquiry as to paternity is refused	Rate per 1000 births	Countries where inquiry is allowed	Rate per 1000 births
Belgium	77	Austria	144
France	74	Saxony	127
Italy	73	Bavaria	132
Holland	30	Sweden	101
Russia	28	Denmark	101
		Scotland	84
		England and Wales	48
		Switzerland	47
		Ireland	25

The presence in society of illegitimate children might be expected to involve serious economic and moral evils, since they are frequently deserted by their natural protectors, and since by heredity and environment they would naturally tend toward pauperism and crime. The greater death-rate among this class of children diminishes these social and economic effects. The following table shows the death-rate among infants under one year in each class, in the countries named:

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* As the United States keeps no official record of births, no authentic statistics for that country can be given.

COUNTRY	Per cent. deaths among legitimates	Per cent. deaths among illegitimates
Austria	24.5	33.3
France	15.5	30.0
Belgium	16.1	26.2
Norway	9.9	12.16
Prussia	19.3	34.8
Bavaria	29.3	38.6
Württemburg	29.6	36.4
Berlin	25.0	32.8

It will be seen that the average rate of infant mortality is 25 per cent. higher among illegitimates than among legitimates. Even more difference is shown by the tables of François. According to these tables the death-rate is twice as high in Spain, Hungary, Sweden, and Denmark. Investigations undertaken to show the physical and moral development of illegitimates are inconclusive in results. This question has been studied in Germany, and more experiments seem to show that illegitimates do not differ greatly from the normal. For example, of 277 illegitimates examined for military service in Berlin in 1870, there were 90 accepted; of the same number of legitimates, 95 were accepted. Among criminals investigations have shown that the illegitimates furnish a large number of those arrested for theft and for begging.

An important question from the standpoint of the economist and public financier is the burden imposed by illegitimacy upon the public. It may work against the welfare of the State by unduly increasing the population, because it removes the feeling of responsibility felt by those who know they must support those whom they bring into the world. The more practical and immediate aspect of the problem, however, is the expense the State must meet in caring for the illegitimates. The importance of this item depends on three conditions: First, the actual number of those thrown on the public; second, the share of this burden borne by private charity; third, the degree of responsibility placed on the reputed parents as to the support of the illegitimate children. This leads to a detailed study of charity work, however, for which reference must be made to that head.

As to the support of illegitimates, the common-law rule is that the putative father of a bastard child is not liable for its support, this obligation falling legally on the mother.

By statute law, both in England and most of the United States, upon complaint of the mother or of certain designated public officers, an inquiry may be had as to the identity of the putative father, and upon sufficient proof an order of affiliation made whereby the father is adjudged to pay for the support of the child. Consult Lappingwell, *Illegitimacy* (New York and London, 1892).

Under common law, an illegitimate child can neither inherit nor transmit property. The exception to this rule is that to his own offspring he may will property of his own accumulation. Laws of the United States have modified this condition, and as a rule, allow inheritance and transmission of property through the mother.

The legitimation of children born out of wedlock by statute law in most of the States follows upon the intermarriage of the parents and acknowledgment of the children. The legitimation of illegitimates secures them, in general, all the privileges of children born in wedlock. It therefore carries with it the right of property and inheritance and the name of the father. In England the intermarriage of the parents at any time before the birth of the child legitimates the child. English law recognizes the status of the child in the place where the parents were domiciled. In the civil and canon law, the intermarriage of parents has always made the child legitimate. This is the law of Scotland, Holland, Germany, and France.

ILLICIUM, ĭl-lĭsh'ĭ-ŭm (Neo-Lat., from Lat. *illicere*, to allure, from *in*, in + *lacere*, to entice). A genus of trees of the natural order Magnoliaceæ, the members of which have flowers with three or six petal-like sepals, numerous petals arranged in several rows, many stamens and pistils, capsules arranged in a star-like form, opening upward, and each containing a single seed. The species are few, but very widely distributed. The most important is *Illicium anisatum*, star or Chinese anise, the fruit of which is used in medicine and as a condiment. This tree is held in high esteem by the Japanese, and is planted near their temples. The star anise of commerce is now derived principally from Anam. Among the other species is *Illicium floridanum*, a shrub with pendent clusters of dark purple flowers, native of Florida and Louisiana, of which the leaves and capsules smell like anise, though more faintly than those of the Chinese tree. Similar in fragrance is *Illicium parviflorum*, another Floridian species. See ANISE.

ILLIGEN, ĕl'lĕ'zhäN', ANDRÉ (1638-70). A French buccaneer, native of Ixelles, near Brussels. From the merchant service of the Netherlands, he passed into that of the French filibuster Montbars, who had saved him from the Spaniards, and together they sacked cities and ships of the enemy. Illigen afterwards worked with the famous Welsh pirate Sir Henry Morgan, with whom he coöperated during some of the latter's noted expeditions against the possessions of Spain in the West Indies and South America.

ILLIMANI, ēl'yê-mä'nê. A volcano in the Bolivian Andes, South America, situated about 25 miles southeast of the city of La Paz (Map: Bolivia, D 7). It is surmounted by four peaks, of which one, Condor Blanco, is over 20,800 feet high. It is covered with perpetual snow above 15,000 feet, whence its name, signifying 'snow mountain.' There is a lake in the mountain mass 15,900 feet above the sea, and glaciers on the north side at an altitude of 16,350 feet. The first ascent to the summit of the central peak was made in 1877 by Wiener, Grumbhow, and Ocampo.

ILLINOIS, ĭl'lĭ-noi' *or* -noiz' (American Indian, *Illini*, men). A group of North American Indian tribes belonging to the great Algonquian linguistic family (see ALGONQUIAN STOCK) and originally occupying the State that received their name. La Salle speaks of Lake Michigan as Lac des Illinois. Some of the separate tribes in this group were the Cahokias, after whom the gigantic pyramidal mound opposite Saint Louis was named, Kaskaskia, Michigami, Moingwena, Peoria, and Tamaroa. Most of them have left the record of their existence in place names here and there about the State.

A point of interest relating to the Illinois and other Algonquian tribes in the Ohio Valley is the question of their connection with the people who erected the great truncated pyramidal earth mounds in the Mississippi bottoms, in the western part of the State.

The Illinois came early into relations with La Salle (1670-82) and the French traders. Through the influence of the Trappist monks these tribes were held loyal to the French in their wars with the neighboring tribes and afterwards with the English.

At the close of the Revolution the United States had great difficulty in subduing the Indians of this area. They now number 172, and are situated on a reservation in the Indian Territory.

ILLINOIS. 'The Prairie State.' A north-central State of the United States, lying between latitudes 36° 59′ and 42° 30′ N., and longitudes 87° 35′ and 91° 40′ W. It is bounded on the north by Wisconsin, on the northeast by Lake Michigan, on the east by Indiana, on the south by the Ohio River, separating it from Kentucky, and on the west by the Mississippi, flowing between it and Missouri and Iowa. Its greatest length is 385 miles; extreme width, 218 miles. Area, 56,650 square miles, of which 650 miles are water.

TOPOGRAPHY. The whole State lies within the great prairie region, and has the physical appearance of a broad plain sloping slightly toward the south and southwest. After Louisiana and Delaware, it is the most level State in the Union. The surface of the plain, however, is not so monotonous as it appears on the map, being broken by minor undulations in a series of low hills and broad hollows. In the extreme northwest there are hills rising to an altitude of more than 800 feet, but the average elevations range from 600 feet in the north to 300 feet in the south. The elevation of Chicago is 582 feet. With the Ohio, Mississippi, and Lake Michigan on its borders, the State is well favored as to navigable waterways. The minor streams, with the exception of a few in the northeastern part, flow into the Wabash, Ohio, and Mississippi. The largest of these, the Illinois, has a course of nearly 500 miles, and can be ascended by small boats for a distance of 250 miles from its mouth. It drains central Illinois, receiving as affluents the Kankakee, Des Plaines, Fox, Vermilion, Mackinaw, Spoon, and Sangamon. Among the other important rivers are Rock River in the north, and the Kaskaskia, Big Muddy, Little Wabash, and Embarras in the south. Lake Peoria, in the central part of the State, is formed by a widening of the Illinois River.

FLORA AND FAUNA. See paragraphs on these topics under UNITED STATES.

CLIMATE AND SOIL. The climate is typically temperate, the mean annual temperature ranging from 47° to 54° F. The winters are somewhat severe owing to the northerly winds, which have an unobstructed sweep over the prairies. Vegetation starts in April, and frosts occur about the middle of September. The average annual rainfall is thirty-eight inches. The soil consists of a rich, warm loam almost free from pebbles, and is mostly of glacial origin. An underlying stratum of hard clay prevents the seepage of moisture. On the river bluffs in the western part a fine, sandy deposit, called loess, occurs quite commonly, while the bottom lands have a surface of alluvial silt. The soils are remarkably fertile and require little artificial preparation to fit them for the growth of cereals.

GEOLOGY AND MINERAL RESOURCES. During the Glacial period the area of Illinois was overrun by the northern ice sheet, which spread out a mantle of drift over the surface, burying the preëxistent topography. Only where the rivers have eroded their channels through this glacial material do the underlying formations outcrop. Silurian strata predominate in the northern part, and Devonian and Carboniferous in the central and southern parts. The coal-fields cover an area of 37,000 square miles; the number of seams varies from 7 to 12, with a thickness of 2 to 8 feet. The coal is bituminous, of Carboniferous age, and is best adapted for steaming. The most productive mines are located in Sangamon, Saint Clair, Vermilion, Macoupin, La Salle, Grundy, Williamson, and Bureau counties.

MINING. This industry is of little importance when compared with agriculture and manufacturing. Nevertheless, the production of bituminous coal has assumed enormous proportions. Illinois ranks second among the States in the amount of coal mined, and the output amounts to nearly 10 per cent. of the total for the country. The value of the annual output has increased from $10,000,000 in 1886 to $28,163,937 in 1901. Limestone is extensively quarried, the product being used for building and road-making purposes. The value of the annual output for the last decade has averaged about $2,000,000. Both of the above products are procured from a number of widely scattered points. The discovery and the mining of lead in the northwest corner of the State played an important part in the early settlement of the commonwealth. It is still mined to a limited extent. Some zinc is also mined in the northern part of the State. Fine clay and other commercial clays are mined, and the manufacturing of lime and of cement are well-established industries. The mineral waters of the State are also of considerable commercial value.

FISHERIES. Many of the streams of the State abound in fish, which, though of little importance compared with the total food-supply, are yet worthy of consideration. German carp and buffalo-fish are commercially of most importance. Twenty shipping points on the Illinois River report the total value of fish caught for the year 1899 as $362,000. The protection and fostering of the fishing resources of the State are placed under the supervision of a State board of fish commissioners.

AGRICULTURE. For several years following 1870 Illinois exceeded all other States in the per cent. of its farm area, in the per cent. of farm land improved, and the acreage in crops, and at the end of the century was exceeded in these respects by only one State—Iowa. According to the census of 1900, 91.5 per cent. of the land area was included in farms, of which 84.5 per cent. was improved, each of these per cents. being the largest given in any Illinois census. In the greater part of the State the soil is a black loam of great fertility. The average size of farms decreased gradually until 1880; since then it has remained almost constant, being 124 acres in 1900. The per cent. of tenant-operated farms is rapidly increasing, amounting in 1900 to 39 per cent. of the total number. The share system of renting is most common. The products raised are of great variety, but corn has always been predominant, the number of acres devoted to its cultivation being twice that of any other crop. For a long time Illinois was the foremost corn State, but in recent years that place has been surrendered to Iowa, while Kansas and Nebraska have each in occasional years had a greater acreage. A very high point in the corn production in Illinois was reached in the late seventies, followed by a gradual falling off of more than one-third; it revived, however, in the decade 1890-1900, the figure for the latter year being the highest reached. In 1880 3,200,000 acres under wheat exceeded that for any other State; but for the last decade of the century it has averaged only a little over half that amount, giving the State a low rank. Oats show just the opposite tendency, the crop prior to 1880 having an annual acreage of less than 2,000,000 acres, but since 1885 averaging 3,500,000 acres, the State ranking next to Iowa. Hay, which for the decade 1880-90 had an annual acreage of over 3,000,000 acres, dropped below that figure in the succeeding ten-year period. Illinois is one of the most important potato-producing States with an average acreage of over 150,000 acres. All these crops are grown throughout the State, but the northern part is found especially adapted to hay, the north and central to corn, the eastern to oats, and the southwestern to wheat. Rye and barley are most extensively raised in the northern portion of the State, sorghum, tobacco, and castor beans in the southern, and broom-corn is grown in the central. In the production of the last, the State exceeds all others. Peaches and pears are raised chiefly in the southern part, while apples, grapes, and other fruits are common throughout the State. In 1900 the apple-trees numbered 13,430,000, or 74 per cent. of the total fruit-trees, having nearly doubled in number during the decade ending with that year. The per cent., however, of increase for all other varieties of fruit-trees was much greater than for apple-trees. In the vicinity of Chicago large quantities of small fruits and other products are grown for the Chicago markets. In most parts of Illinois expensive farm drainage systems need to be maintained.

STOCK-RAISING. There being an enormous production of corn and other kinds of stock feed, stock-raising naturally assumes great prominence. For many years the number of horses exceeded 1,000,000, giving the State first rank until 1900, when it was exceeded by Iowa. Large numbers of mules are also raised. The milch cows number about 1,000,000, only Iowa and New York exceeding this figure. Dairy products—milk and butter—constitute one of the leading sources of wealth, and are exceeded in importance in but two other States. In 1899 the dairy product was valued at $29,638,619. Of that sum 64.3 per cent. was actually realized from sales, $14,477,813 being received from the sale of milk. Other cattle during the last decade of the century have averaged a little less than 2,000,000 head, being less in the preceding decade, but now giving the State about fifth rank. For two decades hogs have exceeded 5,000,000 head, Iowa being the only successful rival. Less attention has been given to sheep, which have decreased in number more than half since 1870. The State ranks next to Missouri in number of domestic fowls. The following tables, taken from the census returns for 1890 and 1900, show the relative importance of the different crops and varieties of farm animals, and the changes which have occurred during the decade:

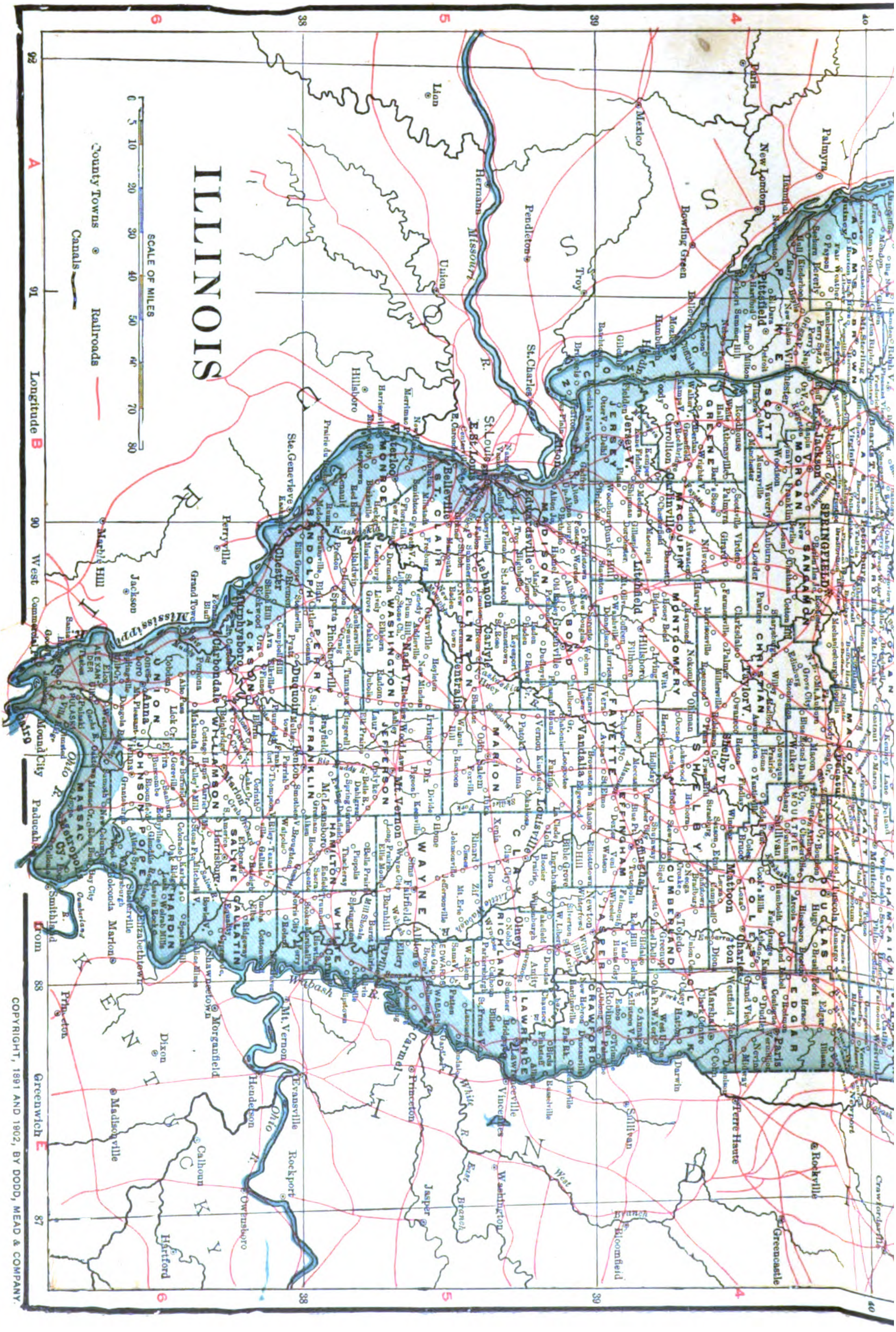
YEAR	Corn (acres)	Oats (acres)	Wheat (acres)	Rye (acres)	Barley (acres)	Hay (acres)	Potatoes (acres)
1900..................	10,266,335	4,570,034	1,826,143	78,869	21,375	3,343,910	136,464
1890..................	7,863,025	3,870,702	2,240,932	165,598	41,390	3,522,884	170,726

YEAR	Dairy cows	Other neat cattle	Horses	Mules and asses	Sheep	Swine
1900............................	1,007,664	2,096,346	1,350,219	127,173	629,150	5,915,468
1890............................	1,087,886	1,975,233	1,335,289	107,875	922,631	5,924,818

MANUFACTURES. Illinois is the most important manufacturing State west of the Alleghany Mountains, and is outranked by only two of the Atlantic Coast States—New York and Pennsylvania. It is a natural collecting and distributing centre for a very large and prosperous area. To Chicago (q.v.) is accredited 70 per cent. of the total manufactured product for the State. From its beginning the city was an important stock market, and it soon far outclassed all other places as a slaughtering and meat-packing centre. From the table appended it will be seen that the value of the products of this industry constitutes over one-third of the total for the twenty-four leading industries of the State, and the greater part of this ($256,537,000) was in 1900 accredited to Chicago. The entire slaughtered animal is utilized, and this gives rise to a large number of subsidiary industries, some of which attain a large magnitude in themselves. Thus the value of soap and candles manufactured exceeds $9,000,000, and the products of the tanning, currying, and finishing of leather are almost as important. The forests to the north and the iron-mines of the Lake Superior region together afford the raw products for a large number of important industries. The manufactures of iron are only possible where an abundant supply of fuel is attainable, and the extensive coal-mining industry of the State abundantly meets this requirement. Only two States exceed Illinois in the manufacture of iron and steel. Chicago is the largest producer of these products among all the lake cities. Joliet has become another important centre for the production of iron and steel. The value of the product for Chicago and Joliet in 1900 was respectively $31,461,000 and $13,380,000. The manufactures of foundry and machine-shop products are even greater in value than is the product of iron and steel. Over two-thirds of the total product is accredited to Chicago. The value of agricultural implements manufactured is more than three times that of any other State, and Pennsylvania alone exceeds Illinois in the production of cars and other railroad supplies. The manufacture of carriages and wagons is also

AREA AND POPULATION OF ILLINOIS BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Adams	A 4	Quincy	838	61,888	67,058
Alexander	E 6	Cairo	230	16,563	19,384
Bond	C 5	Greenville	372	14,550	16,078
Boone	D 1	Belvidere	288	12,203	15,791
Brown	B 4	Mount Sterling	305	11,951	11,557
Bureau	C 2	Princeton	877	35,014	41,112
Calhoun	B 4	Hardin	252	7,652	8,917
Carroll	B 1	Mount Carroll	462	18,320	18,963
Cass	B 4	Virginia	388	15,963	17,222
Champaign	B 3	Urbana	1,000	42,159	47,622
Christian	C 4	Taylorville	688	30,531	32,970
Clark	E 4	Marshall	515	21,899	24,033
Clay	D 5	Louisville	468	16,772	19,553
Clinton	C 5	Carlyle	498	17,411	19,824
Coles	D 4	Charleston	520	30,093	34,146
Cook	E 2	Chicago	903	1,191,922	1,838,735
Crawford	E 5	Robinson	450	17,283	19,240
Cumberland	D 4	Toledo	347	15,443	16,124
Dekalb	D 2	Sycamore	646	27,066	31,756
Dewitt	C 3	Clinton	406	17,011	18,972
Douglas	D 4	Tuscala	420	17,669	19,097
Dupage	D 2	Wheaton	347	22,551	28,196
Edgar	E 4	Paris	648	26,787	28,273
Edwards	D 5	Albion	232	9,444	10,345
Effingham	D 4	Effingham	486	19,358	20,465
Fayette	C 4	Vandalia	692	23,367	28,065
Ford	D 3	Paxton	480	17,035	18,359
Franklin	C 5	Benton	436	17,138	19,675
Fulton	B 3	Lewistown	828	43,110	46,201
Gallatin	D 6	Shawneetown	325	14,935	15,836
Greene	B 4	Carrollton	544	23,791	23,402
Grundy	D 2	Morris	432	21,024	24,136
Hamilton	D 5	McLeansboro	438	17,800	20,197
Hancock	A 3	Carthage	765	31,907	32,215
Hardin	D 6	Elizabethtown	194	7,234	7,448
Henderson	A 3	Oquawka	362	9,876	10,836
Henry	B 2	Cambridge	840	33,338	40,049
Iroquois	E 3	Watseka	123	35,167	38,014
Jackson	C 6	Murphysboro	558	27,809	33,871
Jasper	D 4	Newton	508	18,188	20,160
Jefferson	C 5	Mount Vernon	590	22,590	28,133
Jersey	B 4	Jerseyville	300	14,810	14,612
Jo Daviess	B 1	Galena	656	25,101	24,533
Johnson	D 6	Vienna	340	15,013	15,667
Kane	D 2	Geneva	540	65,061	78,792
Kankakee	E 2	Kankakee	692	28,732	37,154
Kendall	D 2	Yorkville	324	12,106	11,467
Knox	B 3	Galesburg	720	38,752	43,612



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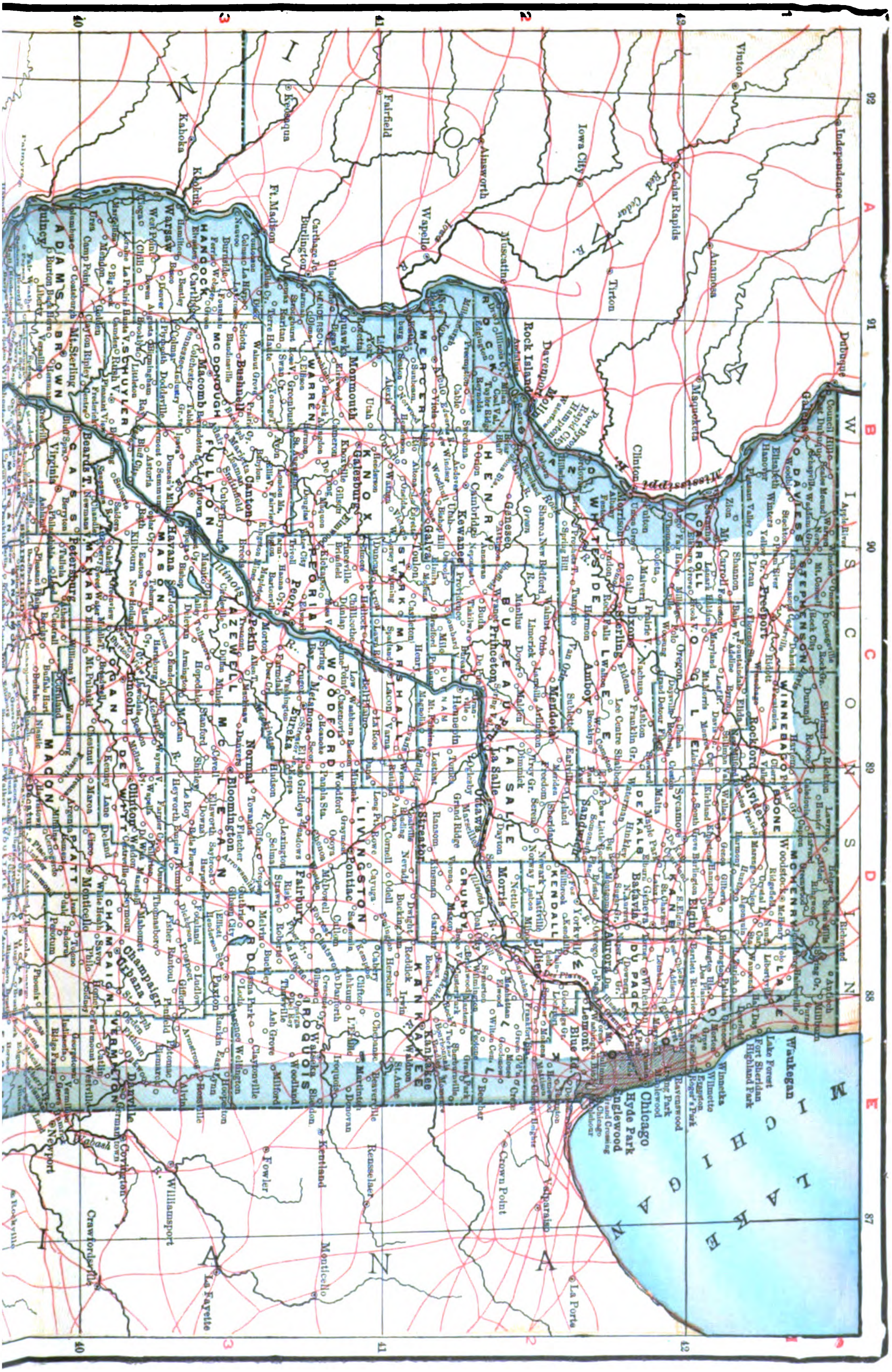

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LAKE MICHIGAN
INDIANA
Mississippi
Illinois R.
Wabash
Red Cedar
Iowa R.
Independence
Vinton
Cedar Rapids
Iowa City
Anamosa
Tipton
Maquoketa
Dubuque
Davenport
Rock Island
Moline
Muscatine
Wapello
Ainsworth
Fairfield
Keosauqua
Kahoka
Burlington
Ft. Madison
Keokuk
Quincy
Clinton
JO DAVIESS
STEPHENSON
WINNEBAGO
BOONE
MC HENRY
LAKE
CARROLL
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KANE
DU PAGE
COOK
WHITESIDE
LEE
ROCK ISLAND
HENRY
BUREAU
LA SALLE
KENDALL
GRUNDY
WILL
KANKAKEE
MERCER
KNOX
STARK
PUTNAM
MARSHALL
LIVINGSTON
IROQUOIS
FORD
WARREN
HENDERSON
PEORIA
WOODFORD
MC LEAN
HANCOCK
MC DONOUGH
FULTON
TAZEWELL
ADAMS
SCHUYLER
BROWN
CASS
MASON
MENARD
LOGAN
DE WITT
PIATT
CHAMPAIGN
VERMILION
MACON
Freeport
Rockford
Belvidere
Woodstock
Waukegan
Lake Forest
Fort Sheridan
Highland Park
Winnetka
Evanston
Elgin
Aurora
Joliet
Lemont
Blue Island
Chicago
Hyde Park
Englewood
Sterling
Dixon
Amboy
Mendota
Princeton
La Salle
Ottawa
Morris
Streator
Pontiac
Kankakee
Galesburg
Monmouth
Kewanee
Peoria
Pekin
Canton
Macomb
Havana
Bloomington
Normal
Champaign
Urbana
Danville
Paxton
Monticello
Clinton
Crown Point
Valparaiso
La Porte
Rensselaer
Kentland
Fowler
Williamsport
La Fayette
Crawfordsville
Covington
Newport
Rockville
Monticello

AREA AND POPULATION OF ILLINOIS BY COUNTIES.

(*Continued.*)

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Lake	D 1	Waukegan	463	24,235	31,504
Lasalle	C 2	Ottawa	1,156	80,798	87,776
Lawrence	E 5	Lawrenceville	362	14.693	16,523
Lee	C 2	Dixon	738	26,187	29.894
Livingston	D 3	Pontiac	1,030	38,455	42.035
Logan	C 3	Lincoln	610	25,489	28.680
McDonough	B 3	Macomb	574	27,467	28,412
McHenry	D 1	Woodstock	609	26,114	29,759
McLean	C 3	Bloomington	1,166	63,036	67,843
Macon	C 4	Decatur	606	38,083	44,003
Macoupin	B 4	Carlinville	868	40,380	42,256
Madison	D 5	Edwardsville	748	51,535	64,694
Marion	C 5	Salem	570	24,341	30,416
Marshall	C 2	Lacon	390	13,653	16,370
Mason	C 3	Havana	570	16,067	17,491
Massac	D 6	Metropolis City	238	11,313	13.110
Menard	C 3	Petersburg	314	13,120	14,336
Mercer	B 2	Aledo	558	18,545	20,945
Monroe	B 5	Waterloo	385	12,948	13,847
Montgomery	C 4	Hillsboro	702	30,003	30,836
Morgan	B 4	Jacksonville	562	32,636	35,006
Moultrie	D 4	Sullivan	354	14,481	15,224
Ogle	C 1	Oregon	773	28,710	29,129
Peoria	C 3	Peoria	615	70 378	88,608
Perry	C 5	Pinckneyville	430	17,529	19.830
Piatt	D 4	Monticello	440	17.062	17,706
Pike	B 4	Pittsfield	815	31,000	31,595
Pope	D 6	Galconda	364	14,016	13,585
Pulaski	C 6	Mound City	192	11,355	14.554
Putnam	C 2	Hennepin	176	4.730	4,746
Randolph	C 5	Chester	580	25,049	28.001
Richland	D 5	Olney	360	15,019	16,391
Rock Island	B 2	Rock Island	440	41,917	55.249
St. Clair	B 5	Belleville	680	66.571	86.685
Seline	D 6	Harrisburg	380	19,342	21,685
Sangamon	C 4	Springfield	860	61,195	71,593
Schuyler	B 3	Rushville	430	16,013	16,129
Scott	B 4	Winchester	255	10.340	10,455
Shelby	D 4	Shelbyville	780	31,191	32.126
Stark	C 2	Toulon	292	9,982	10.186
Stepheson	C 1	Freeport	557	31,338	31.933
Tazewell	C 3	Peking	650	29,556	33,221
Union	C 6	Jonesboro	400	21.549	22.610
Vermilion	E 3	Danville	928	49.905	65.635
Wabash	E 5	Mount Carmel	226	11,866	12 583
Warren	B 3	Monmouth	540	21,281	23,163
Washington	C 5	Nashville	555	19,262	19.526
Wayne	D 5	Fairfield	725	23,806	27.626
White	D 5	Carmi	512	25,005	25.386
Whiteside	B 2	Fulton	709	30,854	34,710
Will	D 2	Joliet	835	62,007	74,764
Williamson	C 6	Marion	442	22,226	27.796
Winnebago	C 1	Rockford	540	39,938	47,845
Woodford	C 3	Eureka	526	21,429	21,822

of great importance; but it is interesting to note that while the production of these vehicles scarcely increased at all during the decade, the production of bicycles and tricycles increased 82.3 per cent. during that decade, and has become almost as important. The production of bicycles and tricycles in 1900 was about double that of any other State. Of the manufactures dependent more wholly upon wood, the most important is furniture, confined almost exclusively to Chicago, while planing-mill products and other lumber and timber products are more generally distributed throughout the State. There are important manufactures depending largely upon agriculture for raw materials. The most important of these are manufactures of liquor, flouring and grist-mill products, glucose, cheese, butter, and condensed milk. About two-thirds of the total manufactures of liquors represent distilled liquors. Peoria leads in the industry, and is the largest producer of fine high wines in the United States. The glucose plants of the State make thirty-five distinct products directly from corn, and consume 20 per cent. of the corn crop of the State. Chicago has become an important centre for the manufacture of men's and women's factory-made clothing as well as of boots and shoes, and has a very large printing and publishing business. The manufacture of electrical apparatus and supplies, although almost wholly the development of the last decade, has become an industry of first rank. The manufacture of musical instruments also experienced a very significant gain during the decade. The greatest absolute increase in the manufactures of the State was made in the decade 1880-90. During the last census (1900), however, the percentage of the entire population engaged as wage-earners in the industry was greater than in any previous census, being 8.2 per cent., or 395,110 persons. It will be seen from the table that the per cent. of increase for the number of establishments is greater than the per cent. of increase for the value of products; but in a number of the more important in-

INDUSTRIES	Year	Number of establishments	Average number	Value of products, including custom work and repairing
Total for selected industries for State	1900	8,209	219,415	$810,477,419
	1890	5,459	159,281	621,123,759
Increase, 1890 to 1900	......	2,750	60,134	$189,353,660
Per cent. of increase	......	50.4	37.8	30.5
Per cent. of total of all industries in State	1900	21.4	55.5	64.4
	1890	26.7	56.8	68.4
Slaughtering: Total	1900	64	27,861	$287,922,277
	1890	81	17,932	212,291,382
Slaughtering and meat-packing, wholesale	1900	51	27,626	279,842,835
	1890	60	17,240	200,414,531
Slaughtering, wholesale, not including meat-packing	1900	13	235	8,079,442
	1890	21	692	11,876,851
Soap and candles	1900	39	1,556	9,436,430
	1890	35	1,026	9,857,550
Leather, tanned, curried, and finished	1900	27	2,263	7,847,835
	1890	30	1,864	8,240,808
Iron and steel	1900	26	16,642	60,144,061
	1890	24	8,685	39,011,061
Foundry and machine-shop products	1900	758	31,851	63,878,352
	1890	408	17,200	38,898,114
Cars and general shop construction and repairs by steam railroad companies	1900	98	13,803	16,580,424
	1890	70	10,277	12,208,617
Cars (steam railroad), not including operations of railroad companies	1900	17	9,314	24,845,606
	1890	9	6,879	17,117,223
Agricultural implements	1900	94	18,231	42,033,796
	1890	100	9,502	24,609,660
Carriages and wagons	1900	407	4,355	9,210,379
	1890	559	4,912	9,041,725
Bicycles and tricycles	1900	60	4,388	8,960,421
	1890	5	658	970,000
Furniture, factory product	1900	148	9,757	15,285,475
	1890	169	8,504	14,406,835
Lumber and timber products	1900	837	3,526	7,652,118
	1890	363	4,089	5,185,155
Lumber, planing-mill products, including sash, doors, and blinds	1900	240	5,122	11,141,771
	1890	206	8,929	20,468,903
Liquors: Total	1900	114	3,607	57,941,897
	1890	95	3,621	65,660,783
Flouring and grist-mill products	1900	871	2,111	31,006,294
	1890	647	3,550	37,974,885
Cheese, butter, and condensed milk, factory product	1900	527	1,483	12,879,299
	1890	262	1,344	8,004,991
Glucose	1900	6	2,680	18,122,814
	1890	4	878	4,370,322
Clothing, men's, factory product	1900	900	14,977	37,378,717
	1890	199	16,004	33,626,441
Clothing, women's, factory product	1900	169	4,402	9,774,774
	1890	71	2,513	6,422,431
Boots and shoes, factory product	1900	55	5,553	11,434,842
	1890	56	3,992	8,756,824
Printing and publishing: Total	1900	2,006	17,986	39,449,032
	1890	1,386	14,228	32,060,913
Musical instruments and materials: Total	1900	45	4,670	8,156,445
	1890	25	1,843	3,546,339
Electrical apparatus and supplies	1900	82	6,048	12,169,425
	1890	11	260	486,730
Clay products: Total	1900	619	7,229	7,224,915
	1890	644	10,596	7,956,082

dustries a very decided tendency toward centralization is evident. The accompanying table shows the relative importance of the leading industries, and the changes which have occurred in the last census period.

TRANSPORTATION AND COMMERCE. The State has water communication with the Mississippi Valley and a southern outlet to the Atlantic. Lake Michigan, which touches the State at the northeast corner, gives water communication with Canada and the Lake States, and an eastern outlet to the Atlantic. The Illinois and Michigan Canal, constructed from the lake to the head of navigation on the Illinois River, connects the two water systems. The railroads are more numerous and have a greater extent of track than those of any other State. This is owing in part to the favorable situation for commerce and travel, and partly to the almost level surface of the land, which reduces the cost of construction to the lowest point. Chicago and Saint Louis are the two focal points for the railroads of the State; indeed, most of the grand trunk lines of the continent converge at the former place. The Illinois Central, through the encouragement of extensive land grants by the Government, was constructed in 1850-56, and was the first line in the State. The line still pays into the State treasury 7 per cent. of its gross earnings, being otherwise exempt from taxation. The railway mileage by decades is as follows: 1860, 2790; 1870, 4283; 1880, 10,165; 1900, 10,814. There are about 20 miles for every 100 square miles of territory, and about 23 miles for every 10,000 inhabitants. In 1900 there were 116 railroad corporations having lines within the State. The number of passengers carried during the year mentioned was 42,153,000, the average distance being 24.12 miles. The tons of freight hauled amounted to 88,307,000, the average distance being 116.65 miles. Thus the great natural resources of the State, together with its admirable land and water facilities for transportation, and its central location, give it a high rank in commercial importance. Chicago is the great collecting and distributing centre of the Middle West. Recent improvement in the navigation of the Saint Lawrence makes it possible for the smaller ocean vessels to reach the Chicago port, and though this is not yet considered commercially practicable, it is confidently expected that further improvements will result in the development of a large foreign traffic directly with the Chicago port. See CHICAGO.

BANKS. In 1902 there were 276 national banks in the State with a capital stock of $44,930,000; deposits, $238,459,000; cash, etc., $53,537,000; and loans, $282,007,000. The State banks numbered 190, with a capital of $29,840,000; deposits, $232,723,525; cash, etc., $30,534,988; and loans, $171,201,512. The savings banks had deposits of $80,251,287, the average deposit being $309.95. In 1902 the private banks numbered 178, with loans (approximately), $12,386,236; cash, $1,231,918; capital, $3,407,825; and deposits, $23,174,163.

FINANCE. On October 1, 1900, the outstanding bonded debt of the State was $18,500. The balance in the treasury amounted to $2,617,900. The Constitution prohibits the State from rendering financial assistance to railroads, canals, or to any corporation, association, or individual. A similar prohibition is laid upon the local governmental units, but this prohibition expressly excludes cases in which such action was authorized prior to the adoption of the Constitution. The State debt must not exceed $250,000, unless permission is given by direct vote of the people; the local governments may not contract debts exceeding 5 per cent. of their taxable property.

CONSTITUTION AND GOVERNMENT. The present Constitution, which is the third for the State, was adopted in 1870. Amendments may be proposed either by a convention called by a two-thirds vote of each House and authorized by popular vote, or (with a restriction regarding the number) merely by a two-thirds vote of each House; in either case the amendment, to be binding, must be ratified by a majority of the votes cast at a popular election. Manhood suffrage, with the usual restrictions, is the rule in ordinary elections, but women may vote for school officers. There is a primary election law.

LEGISLATIVE. The Senate of 51 members is elected for four years, the House of Representatives for two years. Three Representatives are elected from each of the 51 Senatorial districts. The system of voting for Representatives is intended to secure minority representation; to each voter are allowed three ballots, which he may distribute as he sees fit. Legislators receive $1000 for each regular session, $5 per day for special or called sessions, 10 cents per mile mileage, and $50 for stationery, etc. Regular sessions begin on the first Wednesday after the first Monday in January of odd years. The capital is Springfield.

EXECUTIVE. A Governor, Lieutenant-Governor, Secretary of State, Auditor, Superintendent of Public Instruction, and an Attorney-General are elected for four years each. The Treasurer is elected for two years, and is ineligible for the next succeeding term. The Governor may veto any bill or any item of an appropriation bill, but his veto may be overridden by a two-thirds vote of each House. The Lieutenant-Governor, the President *pro tempore* of the Senate, and the Speaker of the House are in the line of succession in case of a vacancy.

JUDICIAL. The State is divided into seven districts, in each of which a judge of the Supreme Court is elected for nine years; the judges choose one of their number as Chief Justice. Inferior appellate courts also exist. Circuit Court judges are elected for six years, and two or more terms of these courts must be held yearly in each county. A county judge, a State's attorney, and a clerk of the court are elected for four years in each county, but the Legislature may unite two or more counties into a district. Probate courts may be established in counties with a population exceeding 50,000. There are also justices of the peace, police magistrates, and constables.

LOCAL GOVERNMENT. Each county elects three (Cook County, 15) county commissioners for terms of three years. A county clerk, sheriff, treasurer, and coroner are elected for four years, but the sheriff and treasurer are ineligible for the next succeeding term. A notable feature is that counties may decide whether they will adopt the township system; most of them have adopted it.

The State has 25 Representatives in the National House of Representatives.

MILITIA. In 1900 there were 1,091,472 males of militia age. In 1898 the National Guard of the State aggregated 8,490 men and officers.

Population. The Territory of Illinois in 1810 had 12,282 inhabitants. The population of the State by decades is as follows: In 1820, 55,211; 1830, 157,445; 1840, 476,183; 1850, 851,470; 1860, 1,711,951; 1870, 2,539,891; 1880, 3,077,871; 1890, 3,816,351; 1900, 4,821,550. The rank of the State advanced from eleventh in 1850 to fourth in 1860 and third in 1890, which position it still holds. In 1890 it surpassed Ohio for the first time, and became the most populous State west of the Alleghany Mountains. The greatest absolute gain was made in the last decade of the century, the per cent. of increase being 26.0, as compared with 20.7 for the United States. The earlier movements of population into the State were largely composed of Southerners, who crossed the Ohio River into southern Illinois, or were attracted up the Mississippi River to the lead-mining districts in the northwestern part of the State. These, however, were soon greatly outnumbered by immigrants from the Eastern States. Some of the public lands were still unoccupied when the great German migration to America began, and consequently a large number of Germans found homes within the State, and Chicago has continued to be a German centre. The German born are considerably more than twice as numerous as any other foreign nationality, and constitute over one-third of the total foreign-born population. The Scandinavians came a little later, yet in time to secure a firm foothold in the northern part of the State. The Irish element is much less prominent than in the Atlantic Coast States, but is about equal to the Scandinavians in numbers. The more recent immigrants include a large number who are of the Slav or Latin race. The total foreign-born population in 1900 numbered 966,747. The colored population numbered 86,677, of whom 1503 were Chinese. The urban population equals half the total for the State, and the gain during the last decade has been wholly in the towns and cities, the per cent. of gain in these being 53.2. Sixty-six places exceed 4000 in number of inhabitants. The density of population is 86 per square mile, or more than three times that of the nation as a whole. The male sex outnumbers the females by 125,000.

Cities. According to the census of 1900, the cities having a population exceeding 25,000 are as follows: Chicago, 1,698,575; Peoria, 56,100; Quincy, 36,252; Springfield, 34,159; Rockford, 31,051; East Saint Louis, 29,655; Joliet, 29,353.

Religion. Estimated upon the reported number of church communicants, the Methodists about equal the Catholics in their adherents. The Baptists, Disciples of Christ, Presbyterians, German Evangelicals, Congregationalists, Lutherans (General Council), and Protestant Episcopalians follow in importance in the order named.

Education. In 1900 only 4.2 per cent. of the population over ten years of age were illiterate, as compared with 10.7 for the whole country. The free-school system dates from 1855. Rapid progress has been made in perfecting the system, especially in lengthening the school year, the average for recent years having exceeded 150 days. The power of the county superintendent has been increased so that he can supervise the schools without restriction by the county boards. Great inequalities, however, exist throughout the State, due to the inadequacy of local taxes in many of the rural communities, and to lack of centralization. Over 350 schools enroll fewer than 10 pupils each. Lack of funds necessitates short terms and leads to the employment of mediocre teachers. More than one-third of the pupils of the State are enrolled in ungraded schools. The lack of high schools in the rural communities, or any provision for the payment of their tuition in schools outside their district, prevents many from securing the advantages of a secondary education. In 1900 there were 1,588,000 persons between the ages of six and twenty-one. Of these, 958,900 were enrolled in the public schools, the average attendance being 737,576. The per cent. of the children in daily attendance increased from 61 in 1880 to 76.9 in 1900; and the average number of days attendance increased during the period from 91.9 to 123.3. There were also 142,496 children enrolled in 965 private schools. The private secondary schools numbered 65, and the public high schools 321. The public-school teachers numbered 26,303, of whom 6950 were male. The average monthly salary of the male teacher was $60.34, and of the female teacher $52.45.

The total cost to the State of the public schools and educational institutions was, in 1900, $19,919,000. The income from the township school funds amounted to $900,000, while that from the county and State funds approximated $100,000. The average cost per enrolled child was $18.94. The total permanent school fund now amounts to $17,429,000. The largest items are, first, school lands unsold and other lands of an estimated value of $9,571,000, and, second, the township funds, being the net proceeds of the sale of the sixteenth section in each Congressional township, amounting to $5,923,000. The State educational system comprehends higher institutions of learning, of which there are five normal schools, located respectively at Charleston, De Kalb, Macomb, Carbondale, and Normal; an agriculture and mechanic-arts school at Urbana; and a university also at Urbana. In few States has private initiative been more active in establishing higher schools of learning. Thirty-one institutions have assumed the name of 'college' or 'university.' Besides these there are a large number of professional and technical institutions, more modest in name, but equally well known. Cook County Normal School is one of the best known in the whole country, and the University of Chicago (q.v.) has attracted wide attention by its original features and the eminence of the scholars who have been called to fill its chairs. Among the best known of the other institutions are the Northwestern University, the Armour Institute of Technology, and the Rush Medical College, situated at Chicago; Knox College, at Galesburg; and Illinois Wesleyan University, at Bloomington. Most of the higher institutions are coeducational.

Charitable and Penal Institutions. The following is a list of the correctional and charitable institutions of the State, with their situations:

Correctional	*Situation*
Penitentiary (Northern)	Joliet
Penitentiary (Southern)	Chester
State Reformatory	Pontiac
State Training School for Girls	Geneva
Charitable	
Illinois School for the Deaf	Jacksonville
Institution for the Education of the Blind	Jacksonville
Central Hospital for the Insane	Jacksonville
Soldiers' Orphans' Home	Normal
Asylum for Feeble-Minded Children	Lincoln

Charitable Eye and Ear Infirmary	Chicago
Northern Hospital for the Insane	Elgin
Southern Hospital for the Insane	Anna
Eastern Hospital for the Insane	Kankakee
Soldiers' and Sailors' Home	Quincy
Industrial Home for the Blind	Chicago
Asylum for Insane Criminals	Chester
Soldiers' Widows' Home	Wilmington
Western Hospital for the Insane	Watertown
Asylum for Incurable Insane	South Bartonville

The average number of inmates in the charitable institutions for the two years ending in June, 1900, was 9615. The ordinary expense to the State for the last year was $1,416,000, being an average per capita cost (gross) of $158.71. The above charitable institutions, together with the county jails and almshouses, and every association receiving dependent, neglected, and delinquent children, are subject to inspection by the State Board of Charities, consisting of five unsalaried members. While the board exercises a great influence its power is merely advisory, and not executive. The paupers in the almshouses of the State in 1900 numbered nearly 9000. Of these, 3100 were insane. The county system of outdoor relief is in vogue, and as a result the township officer distributes alms with rather more generosity than judgment, making an average county expenditure of 20 cents per capita, while in several counties the combined outdoor and indoor relief consumes half the total county tax. In some respects the State has been exceptionally progressive. Especially noteworthy is the establishment of a juvenile court in counties exceeding 500,000 population, and a system of unsalaried parole officers, the working of which has resulted in a large number of children being cared for outside of prisons or institutions to which they would otherwise have been doomed. Reform methods have also been introduced in the penal institutions, supplemented by a wise parole system.

HISTORY. In 1673 Father Marquette ascended the Illinois River, and two years later established a Jesuit mission at the Indian village of Kaskaskia. La Salle entered the river in 1679, named it Illinois from the tribes inhabiting the region, and built Fort Crèvecœur at the foot of what is now called Lake Peoria. His explorations were continued by Tonty, whom he left behind in 1680 when he returned to Canada. Fort Saint Louis on Starved Rock was built in 1682, and between 1683 and 1690 French traders established themselves at Kaskaskia, Cahokia, and other Indian villages, though the actual settlement of Kaskaskia, the oldest town in Illinois, probably did not occur before 1700. By 1751 there were six important settlements within the present limits of the State. The French showed a remarkable aptitude for controlling the Indians and adapting themselves to their mode of life. Intermarriage between French and Indians was common, and ties of friendship were established which lasted after the power of France had passed away. Pontiac's rising prevented the English for two years from taking possession of the Illinois country ceded to them in 1763. In general, conditions remained unaltered after the English occupation, but many prominent French settlers fled from English rule to Saint Louis, Natchez, and other towns in the valley of the Mississippi. In 1778-79 a force of Virginians under George Rogers Clark (q.v.) captured Kaskaskia and subdued the province. Virginia ceded its claims to the southern part of the region in 1784, Massachusetts and Connecticut gave up their rights in the following year, and in 1787 the region became a part of the Northwest Territory. Ohio was set off in 1800, Indiana in 1802, and Michigan in 1805; what remained was organized as Illinois Territory on February 3, 1809. The hostility of the Indians prevented rapid settlement in the north. On August 15, 1812, the garrison at Fort Dearborn (Chicago) was massacred. On August 18, 1818, the first Constitution was adopted. On December 3 Illinois was admitted into the Union with boundaries so extended to the north as to include the port of Chicago. By 1805 most of the Indian titles to land within the Territory had been extinguished. There ensued a period of wild land speculation, marked by stupendous frauds. The early immigrants, who came chiefly from the South, brought with them a decided predilection for slavery. The first Legislature passed stringent laws to protect the few slaveholders in the State, and from 1818 to 1865 a harsh code of anti-negro laws, known as the 'Black Laws,' was in force. In 1824 an attempt was made to call a convention for the purpose of legalizing slavery in spite of the ordinance of 1787, but the project was quickly and definitely defeated. The murder of Elijah P. Lovejoy (q.v.), at Alton, in 1837, however, showed the persistence of a strong pro-slavery sentiment. After 1820 the people were hurried into an unhealthy state of precarious prosperity. Banks were established at Edwardsville and Shawneetown, entirely on paper credit, and an elaborate system of internal improvements was begun. As the northern part of the State, after the Black Hawk War, commenced to fill up with immigrants from New England and the Middle States, the process of economic development was accelerated. The Illinois and Michigan Canal was begun in 1834, and was built with the proceeds of the sale of public lands granted by Congress. The inception of other public improvements was followed by a panic in 1842, when the State bank suspended specie payments. The people, however, recovered quickly, and in 1850 Congress made an extensive cession of public lands to aid in the construction of the Illinois Central Railroad, an enterprise which contributed greatly to the development of the State. In 1840 the Mormons, who had immigrated from Missouri and founded Nauvoo, began to figure in the politics of Illinois. Welcomed at first, they became in the course of a very few years obnoxious to the mass of the inhabitants. Acting as a unit, under autocratic direction, they succeeded in obtaining exclusive privileges from the Legislature. Their religious practices jarred with the feelings of their neighbors; they were inclined to look upon Gentiles with superciliousness; they were prosperous. Bitter feelings led to hostile action in 1844, when Joseph Smith, founder of the sect, while in prison at Carthage on the charge of treason, was murdered by a mob. In the following year the Mormons left Illinois. In 1858 occurred the great contest for the United States Senatorship between Abraham Lincoln and Stephen A. Douglas. At the outbreak of the Civil War Illinois was in an extremely prosperous condition. It produced three-fifths of all the grain exported to Europe, and was the second State in the Union in railway mileage. During the war the State readily furnished its quota of troops, sending

260,000 men into the field. In peace, its prosperous development continued. In 1865 Chicago had become the leading stock market of the world, and a great grain centre. Legislation between 1865 and 1885 was largely concerned with corporations, and especially with the railroad companies. The Constitution of 1870, replacing the one adopted in 1849, forbade the creation of corporations by special law. A State board of railroad commissioners was created to protect the interests of the State against the railway companies, and the Legislature frequently attempted to fix a maximum for transportation, and to prevent discrimination in rates. Between 1872 and 1875 the farmers of Illinois participated in the widespread Granger movement of the time. (See GRANGE.) On October 8-10, 1871, a fire laid waste a large part of Chicago and rendered 100,000 people homeless. The loss to the city was estimated at nearly $300,000,000. The action of the Mayor in calling in the Federal troops to preserve order during the excitement following the calamity occasioned a bitter dispute between that official and the Governor of the State, who showed himself jealous for the honor of the civil authority. A general feeling of unrest found expression in 1885 and 1886 in bitter strikes and bloody riots; in Chicago an Anarchist crowd attacked the police with pistols and dynamite. In 1893 the Columbian Exposition was held in Chicago. In 1894 a strike of the employees of the Pullman Palace Car Company developed into a general strike of railway men. Traffic in Illinois was almost suspended, and in June lawlessness broke out. Interference with the United States mails led to the intervention of the Federal Government. Chicago was occupied by the Federal troops; the leaders of the strikers were arrested on civil process, and sentenced to short terms of imprisonment for contempt of court. The backbone of the strike was thus broken. In national politics Illinois was Democratic before 1860. In that year it cast its vote for Lincoln, and since that time it has been consistently Republican with the exception of the year 1892, when it voted for Grover Cleveland. In State politics the year 1857 is the line of demarcation between Democratic and Republican ascendency.

The Governors of the State have been as follows:

	TERRITORIAL	
Ninian Edwards		1809-1818
	STATE	
Shadrach Bond	Democrat	1818-1822
Edward Coles	"	1822-1826
Ninian Edwards	"	1826-1830
John Reynolds	"	1830-1834
Joseph Duncan	"	1834-1838
Thomas Carlin	"	1838-1842
Thomas Ford	"	1842-1846
Augustus C. French	"	1846-1853
Joel A. Matteson	"	1853-1857
William H. Bissell	Republican	1857-1860
John Wood	"	1860-1861
Richard Yates	"	1861-1865
Richard J. Oglesby	"	1865-1869
John M. Palmer	"	1869-1873
Richard J. Oglesby	"	1873
John L. Beveridge	"	1873-1877
Shelby M. Cullom	"	1877-1883
John M. Hamilton	"	1883-1885
Richard J. Oglesby	"	1885-1889
Joseph W. Fifer	"	1889-1893
John Peter Altgeld	Democrat	1893-1897
John Riley Tanner	Republican	1897-1901
Richard Yates	"	1901—

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ILLINOIS, UNIVERSITY OF. The State University of Illinois, occupying a site of 600 acres, between the cities of Urbana and Champaign. It was chartered in 1867 as the Illinois Industrial University, and assumed its present name in 1885. In 1870 women were admitted as students, and now form about one-sixth of the whole attendance. The university is divided into six colleges: Literature and arts, science, engineering, agriculture, law, and medicine, including schools of library and science, art and design, music, military science, and pedagogy, and preparatory and graduate departments. The State laboratory of natural history and the United States agricultural experiment station for Illinois are departments of the university, but have separate financial support. The schools of pharmacy, medicine, and dentistry are situated in Chicago. The university owns valuable collections in zoölogy, geology, and other departments, an art gallery, and an excellent collection of historical portraits. The library contains about 60,000 volumes, exclusive of special departmental libraries. The university holds a summer session of nine weeks designed primarily for teachers. It maintains close relations with the high schools of the State through a careful system of inspection and accrediting. It has developed rapidly, and is constantly engaged in scientific investigations bearing upon the interests of the State. In 1902 it had 21 buildings, 300 instructors, and over 3200 students, of whom about 1000 were in attendance at the undergraduate college. At the same time its endowment amounted to $645,000, its buildings and grounds were valued at $1,175,000, and its annual income, mainly derived from legislative appropriations, was $780,000.

ILLINOIS AND MICHIGAN CANAL. See CANAL.

ILLINOIS COLLEGE. The oldest collegiate institution of Illinois, founded in 1829 at Jacksonville, Ill., in part through the efforts of the Eastern organization known as the 'Yale Band.' The curriculum is arranged on the group system, with elective courses after the freshman year, and leads to the bachelor's and master's degrees. The college had, in 1902, 65 collegiate and 42 preparatory students and 18 instructors. At the same time the value of its grounds and buildings was $150,000, and its endowment $155,000. The college library contains about 11,000 volumes, supplemented by about 4000 volumes in the libraries of the literary societies.

ILLINOIS RIVER. An important tributary of the Mississippi, traversing the State of Illinois (Map: Illinois, C 3). It is formed by the junction of the Des Plaines and the Kankakee, 45 miles southwest of Chicago. It flows generally southwest, joining the Mississippi near the mouth of the Missouri. Its length is 500 miles, and it is broad and deep, and navigable for steamers 250 miles to La Salle, whence a ship-canal connects it with the south branch of the Chicago River (q.v.), thus affording uninterrupted water communication between the Great Lakes and the Mississippi. The chief cities on the river are Ottawa and Peoria.

ILLINOIS WESLEYAN UNIVERSITY. A Methodist Episcopal college at Bloomington, Ill. It was founded in 1850, and comprises a preparatory school, a college of letters, with four parallel courses, embodying the elective system, and schools of law, music, and oratory. The degrees conferred in course are B.A., B.S., Ph.B., LL.B., M.A., Ph.D., and the honorary degrees of D.D. and LL.D. The total number of students enrolled in the university in 1902 was 1407, of whom 141 were collegiate and 478 non-resident students. At the same time the faculty numbered 36 instructors. The library contains some 10,000 volumes. The university has an endowment of $200,000, an income of $36,000, and grounds and buildings valued at $150,000.

ILLITERACY (from Lat. *illiteratus*, uneducated, from *in-*, not + *literatus*, educated, from *litera, littera*, letter). The condition of one who cannot read and write his own language. As used in the United States Census, the term includes also those who can read but not write.

There are several methods of determining the percentage of illiterates, and unfortunately the various nations follow different plans. Some statisticians prefer to base their estimates on the number of applicants for marriage licenses who cannot sign their names. Most of the European countries find the percentage from the examinations of the recruits for the army and navy, thus confining the test to men of a certain age. In the United States the census makes inquiry of each person, and takes his or her word, there being no test of any sort. In all countries, children under a certain age are not included, as it is not expected that they should know how to read and write. The age taken naturally affects the percentage. The United States does not count children under ten; Italy fixes the age at six. Naturally, the country which best enforces compulsory school attendance will show the lowest percentage.

The report of the United States Commissioner of Education for 1900 contains the following table for the different countries:

	Per cent.		Per cent.
Germany	0.11	Hungary	28.10
Switzerland	0.30	Greece	30.00
Scotland	3.57	Italy	38.30
Holland	4.00	Russia	61.70
France	4.90	Spain	68.10
England	5.80	Portugal	79.00
Belgium	12.80	Servia	86.00
Ireland	17.00	Rumania	89.00
Austria	23.80		

It is a matter of regret that the United States cannot stand at the head of this list, but the census gives the percentage as 10.7, thus placing the country between England and Belgium. The situation, however, is improving. The census of 1900 says: "Not only has there been an absolute decrease in the number of illiterates since 1880, although a much larger Indian population is comprehended by the figures of the present census than heretofore, but the illiterate population now represents less than one-ninth of the entire population considered as compared with a little more than one-sixth in 1880." That much remains to be done is evident from the fact that 10.9 per cent. of the voters are illiterate. Of the total number of illiterates, 15.5 per cent. could read, but not write. The illiteracy of the whites was 6.2 per cent., as compared with 44.5 per cent. of the negroes. The native whites have a percentage of 6.2, as against 12.9 per cent. of the foreign-born whites. It may seem curious that whites of native parents show a percentage of 5.7 to 1.6 for whites born of foreign parents, but the explanation is that a very large proportion of the native born are living in country districts, while whites of foreign parents are largely in the towns and cities and have better school facilities. This fact suggests a comparison of city and country. The rate of illiteracy among white males over twenty-one years of age in cities of 25,000 and over, and for those outside the cities, is shown for various parts of the country by the following table:

	In cities of 25,000 and over	Outside the cities
North Atlantic division	5.8%	7.3%
South Atlantic division	3.0%	12.8%
South Central division	3.4%	12.6%
North Central division	3.3%	4.6%
Western division	1.7%	5.0%

The high average in the Southern States is to be explained by the lack of proper school facilities in the rural districts. The illiteracy of the negroes is very large, but is steadily decreasing. The Indians show a percentage of 56.2.

Within the various States there is also great divergency in the percentages, showing unequal conditions. Taking one State from each division of the country and showing the average illiteracy of the white males of voting age, and also the highest percentage in any county in the State, gives the following:

Average outside cities of 25,000		Given county showing highest percentage	
Massachusetts	6.6%	Dukes County	8.8%
Delaware	10.8%	Sussex County	15.2%
Alabama	14.1%	Cleburne County	22.5%
Iowa	2.6%	Mills County	4.1%
Montana	3.5%	Missoula County	8.5%

Comparing the sexes, the males constitute 48.7 per cent. of the illiterates, the females 51.3 per cent. Consult: *Census of the United States*, 1900, vol. ii.; *Annual Reports of the Commissioner of Education* (Washington); Reports of Ministers and Departments of Education of various European countries.

ILLUMINATED DOCTOR, THE (Lat. *Doctor Illuminatus*). A title given to Raymond Lully and to Johann Tauler (qq.v.).

ILLU'MINA'TI (Lat. nom. pl., enlightened). A name which has been borne by four different societies. (1) The earliest was that of the *Alombrados* in Spain, followers of a seductive mysticism, curiously compounded of Gnosticism, Lutheranism, and Buddhism. It spread rapidly through Spain about the middle of the sixteenth century, though vigorously combated by the apostle of Andalusia, John of Avila, and by Ignatius Loyola. It was finally suppressed by the Inquisition, though it lingered until the middle of the seventeenth century, and had a few scattered followers even at the beginning of the eighteenth. Consult Pelayo, *Historia de los* *heterodoxos españoles* (Madrid, 1880). (2) A group of enthusiasts and visionaries, known as *Guérinets*, in France about 1684. (3) An association of mystics in Belgium in the latter half of the eighteenth century. (4) A society to which the name is now most commonly applied, the *Order of the Illuminati*, which was founded at Ingolstadt on May 1, 1776, and soon spread over almost all the Roman Catholic parts of Germany. Its founder at first called it the 'Order of the Perfectibilists.' It owed its existence to Adam Weishaupt, professor of canon law at Ingolstadt, a man of superior abilities and much benevolence, but deficient in practical knowledge of mankind. Impatient of restraints imposed on the human mind, he conceived the idea of forming an association which should consist of the choicest spirits, labor for the establishment of the dominion of reason, and promote religious and political enlightenment and emancipation. Religious dogmas and forms of worship were to be rejected, a system of deism was to be propagated together with republican opinions. The accession of Baron von Knigge to the new Order, and the support which it received from the Freemasons, led to its rapid extension. Weishaupt's knowledge of the Order of the Jesuits, whose pupil he had been, led him to borrow some of the methods of organization which had proved so successful in their hands for building up a strong and united system, though he meant to use them for the most opposite ends. His arrangements were calculated to place the threads all in one hand by which the holy legion was to be led on, as it was imagined, to the benefaction of mankind. But, from this cause, the dissolution of the Order soon ensued. Weishaupt and Knigge, its two leaders, quarreled with one another. The Order began to be openly denounced as dangerous, and on June 22, 1784, an edict was issued by the Elector of Bavaria for its suppression, which was followed by others March 2, 1785, of a more drastic character, and under the prosecution ensuing the Order was suppressed. Weishaupt was removed from his professorship. He returned to Gotha, where he was received and died as Court Councilor, in 1830, at the age of 82. Various other members were severely punished, and the form of justice was not strictly observed in the proceedings against them. Great importance was at one time attached to the Order of the Illuminati, whose secret influence was regarded as a principal cause of many of the political events of the time of the French Revolution. Consult Kloss, *Bibliographie der Freimaurerei und der mit ihr in Verbindung gesetzten geheimen Gesellschaften* (Frankfort, 1844).

ILLUMINATING. See MANUSCRIPTS, ILLUMINATION OF.

ILLUPI, ĭl′lŭ-pĭ (East Indian name), **ILLUPIE, ELLOOPA** (*Bassia longifolia*). An East Indian evergreen tree. The bark is prescribed in cases of itch; the gummy juice is employed as a remedy for rheumatism; the leaves and the milky juice of the immature fruit are also used in medicine; the flowers, roasted or boiled, furnish an article of food, and the seeds yield a greenish fixed oil, known as illupi-oil.

ILLUSION (from Lat. *illusio*, mockery, from *illudere*, to mock, from *in*, in + *ludere*, to play). In general, a distorted or abnormal perception (q.v.). The word is used in English psychology in two principal senses: (1) As the counterpart of hallucination (q.v.), "an assimilation of an hallucinatory character" (Wundt), a distortion or misinterpretation of the contents of perception, due to an abnormal irritability of the sensory centres of the brain-cortex. The distortion

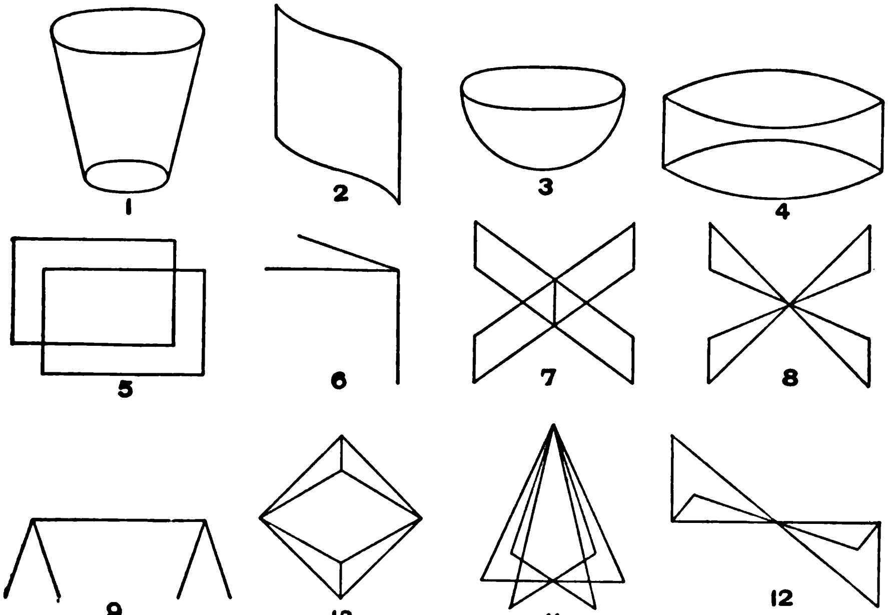

FIG. 1. ILLUSIONS OF REVERSIBLE PERSPECTIVE (from Titchener, *Experimental Psychology*).

Notice that even while you look at the figures, without changing the position of the book, the tops of the figures appear now away from and now toward you.

may take the form of subjective enhancement of the intensity of stimulus, as when a gentle knocking at the door is taken for the growl of thunder; it may involve a qualitative alteration of the stimulus, as when the monotonous sighing of the wind is heard as angelic music; or it may consist in a fantastic modeling and grouping of the forms of perceived objects, as when a dimly seen stone or tree-stump is regarded as a ghost. Sane persons of imaginative disposition are liable to illusion, more especially at times of mental stress or overwork; and, indeed, the readiness with which we can find faces in the fire and monsters in the clouds shows how short is the path from normal to abnormal assimilation. We reach the stage of unquestioned abnormality with patients who interpret the half-heard conversation of passers-by as threats directed against their life, and see on the face of every stranger an expression of disgust or contempt or menace.

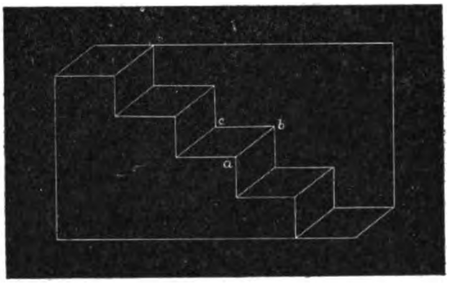

FIG. 2. SCHROEDER'S REVERSIBLE STAIR FIGURE.
The figure fluctuates as you look at it. If at first you seem to be looking at the top of the treads, the appearance soon changes, so that you seem to see the under side of the stairs.

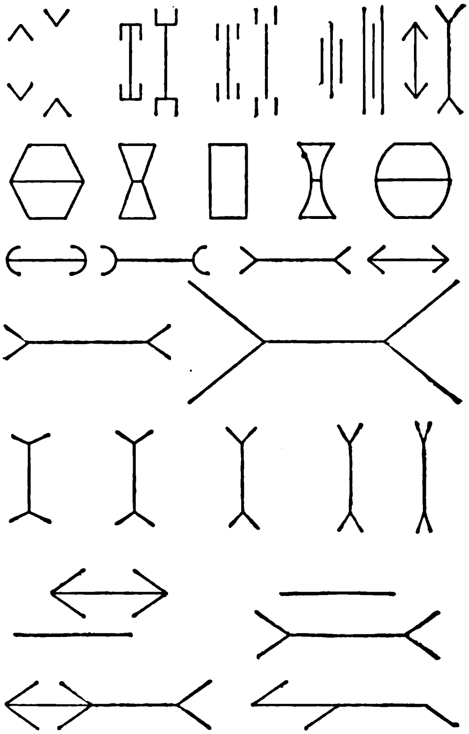

FIG. 4. THE ARROW-HEAD AND FEATHER ILLUSION (from Sanford, *Course in Experimental Psychology*).
In the first row, the distances between the points of the angles are equal, and the 1st, 2d, 4th, 6th, 8th, and 10th to 11th and 12th vertical lines are all equal in length to the distance between the points of the arrows, though they do not appear so. In the second row of figures the top and bottom lines are all equal; in the third and fourth rows the horizontal, in the fifth row the vertical, and in the sixth and seventh rows the horizontal lines are all equal in length. In the last row the parts of the horizontal lines marked off by the points of the angles are all equal.

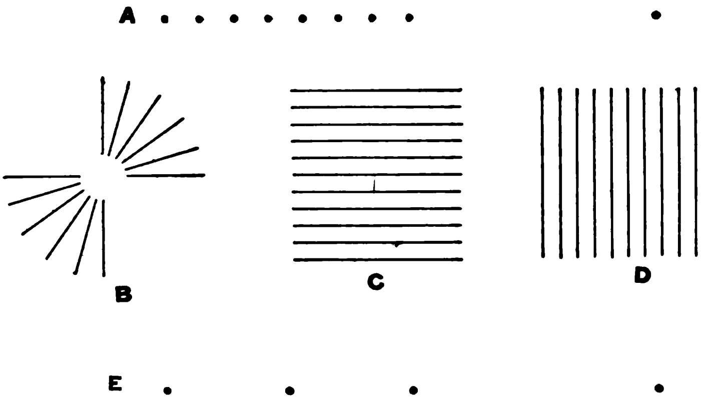

FIG. 3. VARIABLE ILLUSIONS OF EXTENT (from Sanford, *Course in Experimental Psychology*).
In A the space covered by the 8 dots at the left seems greater than that between the 8 and the one at the extreme right. In B the quadrants with inscribed radii appear greater than those that are empty. The figures C and D (Helmholtz's Squares) have a slightly oblong appearance. Figure E is a variant of A, the illusion being the reverse of that in A.

(2) In its second meaning, illusion is a perversion of the contents of perception due to structural or functional peculiarities of the sense-organs. So far from being abnormal, this form of illusion is both natural and necessary. We speak of the perceptions as 'illusory' simply because they are of a character different from that which our previous knowledge of the stimuli, or our experience under other conditions, would lead us to expect. For instance, we know that all four sides of a square are equal. We expect, therefore, that a square will look as high as it is broad. As a matter of fact, the perfect square always looks like a rectangle whose vertical dimension is somewhat greater than the horizontal. Again, we are extremely familiar with the appearance of the circle, which we have seen in all sorts of figures and under the most varied conditions. When, then, we inscribe a square in a given circle, we do not expect that the appearance of circularity will be affected. In actual fact, the circle seems to be pinched in, at the points where its circumference is touched by

the angles of the square, so that we perceive not a circle at all, but four arcs apparently belonging to circles of less radius than the circle which should include the square. No one whose vision is normal can escape these illusions; their occurrence is, as we shall see, intrinsic to the

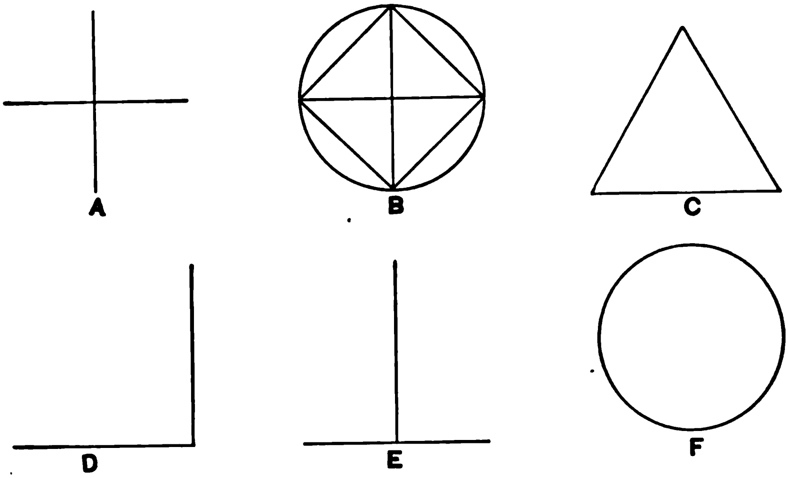

FIG. 5. CONSTANT ILLUSIONS OF EXTENT (from Titchener, *Experimental Psychology*).
The vertical dimensions appear to be greater than the horizontal dimensions of all the figures.

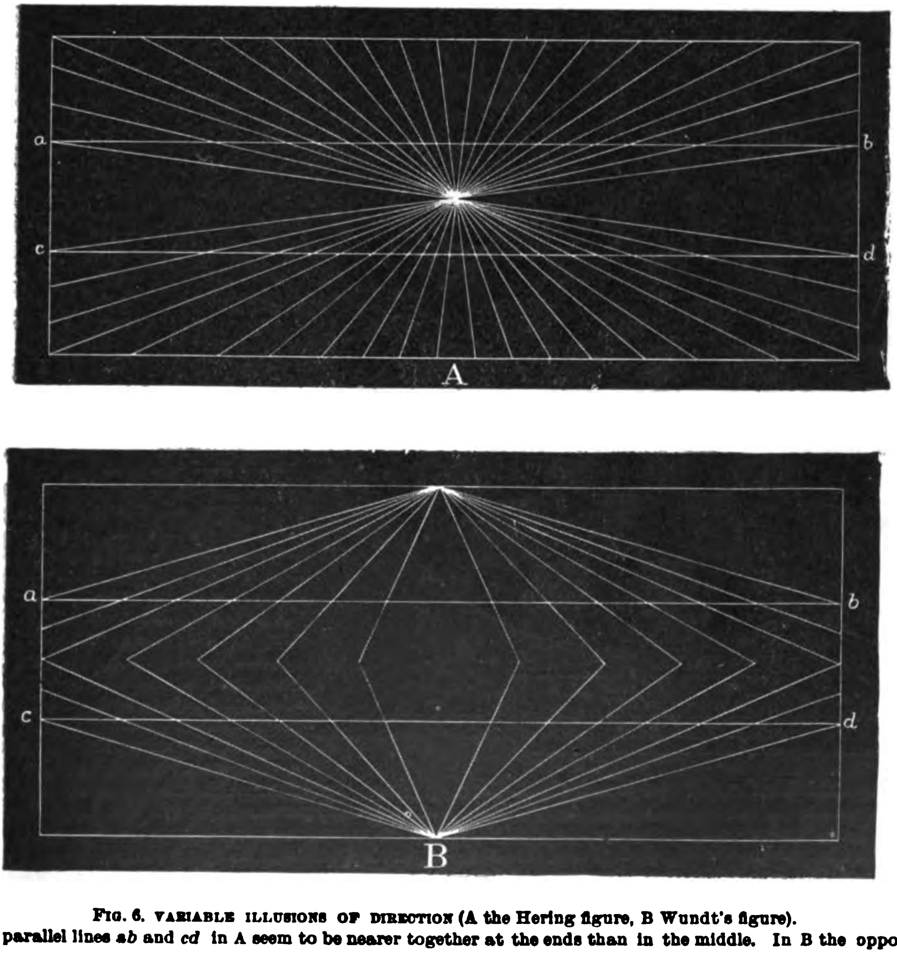

FIG. 6. VARIABLE ILLUSIONS OF DIRECTION (A the Hering figure, B Wundt's figure).
The parallel lines *ab* and *cd* in A seem to be nearer together at the ends than in the middle. In B the opposite is the case.

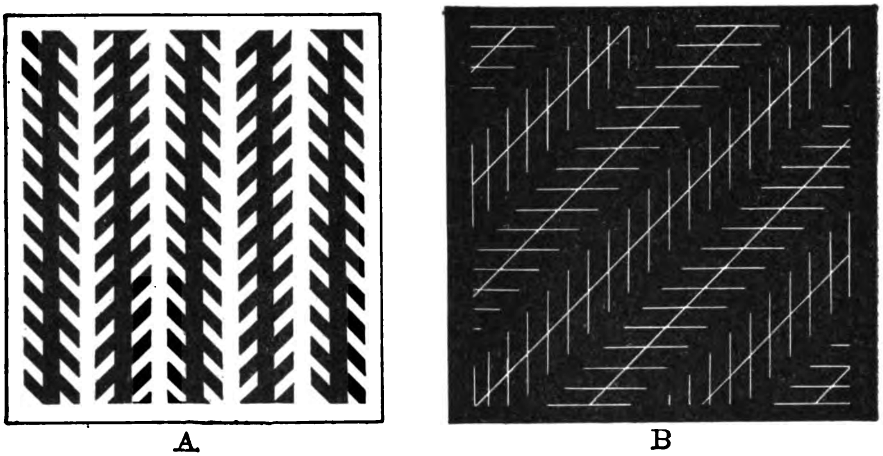

FIG. 7. VARIABLE ILLUSIONS OF DIRECTIONS (Zöllner's Figures).
In A the vertical lines and in B the diagonal lines in the square do not appear parallel, though they are.

working of the eye as a 'space organ'; the perceptions are illusory only in the sense that they conflict with our other knowledge, i.e. with the verdict of the 'mathematical' or 'measuring' eye.

The most important of these 'normal' illusions are the spatial illusions of touch and sight. The latter, which were first demonstrated by J. Oppel (1815-94) in certain simple geometrical figures, have been termed collectively, the *geometrical optical illusions.* They are exceedingly numerous, and explanations have been almost as plentiful as illusions. Two attempts at systematic treatment have, however, been made by later investigators; the one by Wundt (q.v.), who seeks, so far as possible, to account for the illusions in physiological terms (fixation and eye-movement); the other by Lipps (q.v.), who offers a 'mechanical æsthetic' principle of explanation. Lipps's theory is, in brief, that we read into the lines and figures in question forces and counterforces, strivings and resistances, akin to those which we experience in ourselves; so that the column 'seeks' or 'strives' to rise, the horizontal line to stretch itself, the circle to 'hold itself together,' etc. We shall here give Wundt's classification and explanation, on the ground that, in matters of perception, physiological conditions must always have the priority over psychological.

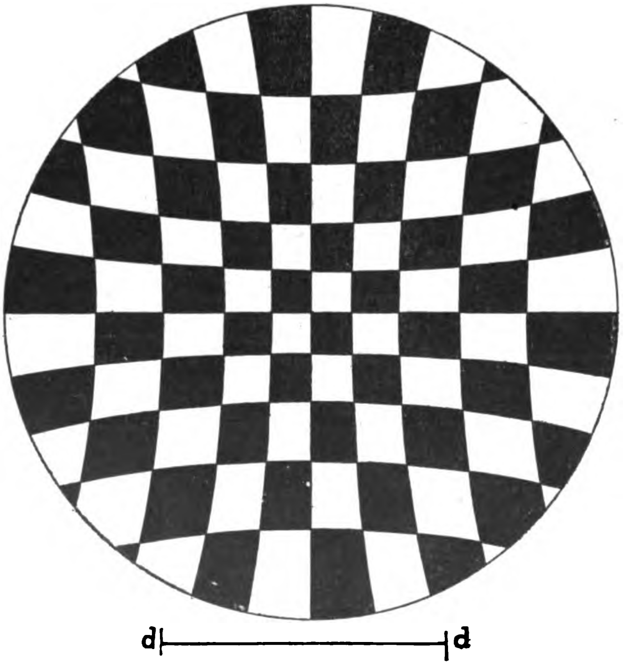

FIG. 8. CONSTANT ILLUSION OF DIRECTION (Von Recklinghausen).
Look at the centre of the figure with one eye, and the lines will appear to be perpendicular to each other and make squares.

The first group of geometrical optical illusions contains (a) the illusions of reversible perspective. It is a familiar fact that many outline figures—a bowl, an open book, a cube, a stairway—will 'turn inside out' in the most perplexing way as one looks at them. Even two crossed lines, drawn X-wise upon a sheet of paper, may be made to take on the appearance of a right-angled cross, seen in perspective, with either the lower or the higher point of the line which forms the horizontal arms nearer to the observer. Very little practice suffices to show that the direction of perspective depends here upon the point fixated and the course along which the eye moves; the point of fixation is the point nearer the observer, and movement of the eye toward a given point brings that, in its turn, to the front of the figure. (b) Next follow the illusions of extent, variable and constant. A dotted line looks longer than a drawn line of equal objective length, for the reason that it offers more halting places as the eye moves along it. Draw an outline square;

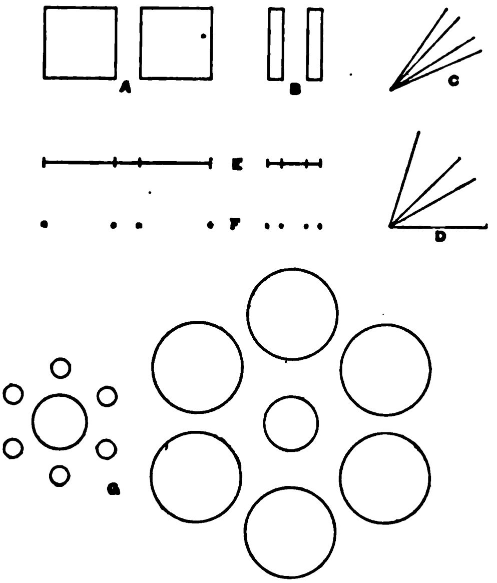

FIG. 9. ASSOCIATIVE ILLUSIONS (from Sanford, *Course in Experimental Psychology*).

For A and B see text. C and D show the same angle differently estimated. E and F are the same kind of illusion as A and B. In G the circle surrounded by small circles is the same in size as that surrounded by large circles, though it appears larger.

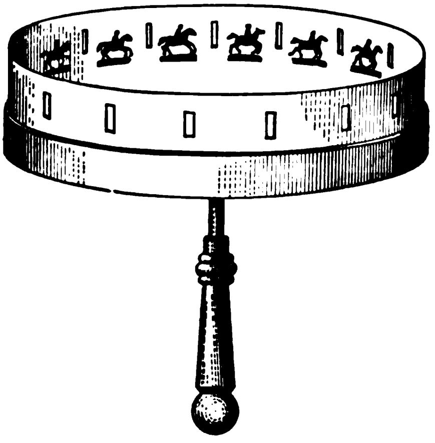

FIG. 10. THE STROBOSCOPE OR ZOËTROPE.

Looking at the figures through the slits in the rim, you get, when the instrument is rotated, an effect similar to and depending on the same causes as that of the kinetoscope.

then a group of horizontal lines, filling the same area as the square; and then a similar group of vertical lines. The horizontal group looks higher, the vertical group broader, than the objectively equal square, for the reason, again, that the grouped lines offer more obstacles to the passage of the eye over the area of the figure. One of the most disputed figures of this class is the illusion of Müller-Lyer, or the arrow-head and feather illusion. Draw two vertical or horizontal lines of equal length. Tip the two ends of the one with oblique lines directed inward (arrow-heads), and the two ends of the other with oblique lines of the same length directed outward (arrow feathers); the latter appears considerably the longer of the two. Wundt's explanation is that the inward-going obliques offer a check to the passage of the eye along the principal line, while the outward-going obliques favor a continuance of eye-movement. The constant illusions of extent (due to asymmetries of muscular action about the eyeball) are summed up in a right-angled and equal-armed cross. The vertical line in this figure seems to be longer than the horizontal; the upper vertical arm longer than the lower; and, in monocular vision, the outer horizontal arm looks longer than the inner. (c) Thirdly, we have variable and constant illusions of direction. Draw a large outline square, marking in one of the diagonals, and three or four lines parallel to the diagonal, at equal distances on either side of it. Now proceed to cross-hatch the oblique lines, cutting the diagonal with short vertical pieces, the two adjoining obliques with short horizontal pieces, the two oblique lines next beyond these with verticals again, the two next with horizontals, and so forth. Notice that the parallel obliques no longer look parallel, but appear to converge and diverge alternately. The explanation of this and similar illusions is that small angles are overestimated, and large angles relatively underestimated; and the reason for such overestimation, again, is that it takes more muscular effort and energy to start a movement of the eye than it does to continue a movement already begun. The constant illusion of direction is that, under certain conditions of fixation, hyperbolas are perceived as straight lines, owing to the concavity of the retina. (d) There remains a group of illusions which Wundt classes as 'associative,' i.e. as psychological, not physiological, in origin.

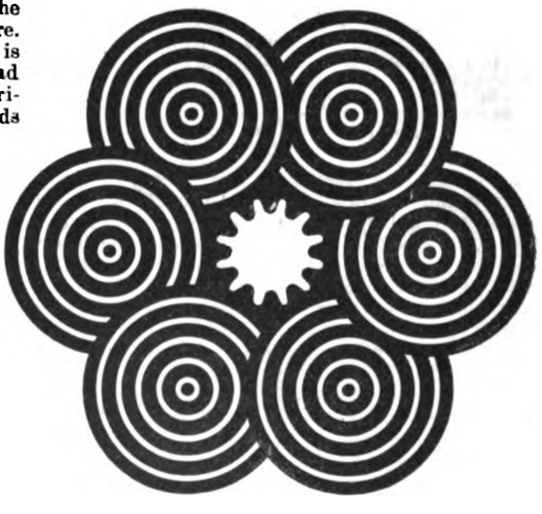

FIG. 11. AN ILLUSION OF MOVEMENT.

Move the figure around in a circle in its own plane, and observe the apparent motion of the six outer disks and the central cog-wheel. (From Sanford, *Course in Experimental Psychology*.)

If equal short horizontal lines are drawn, some grouped closely together, and some widely spaced, the latter appear longer than the former; the length of the line is 'assimilated' to the size of the interspaces. In the same way, if two broad

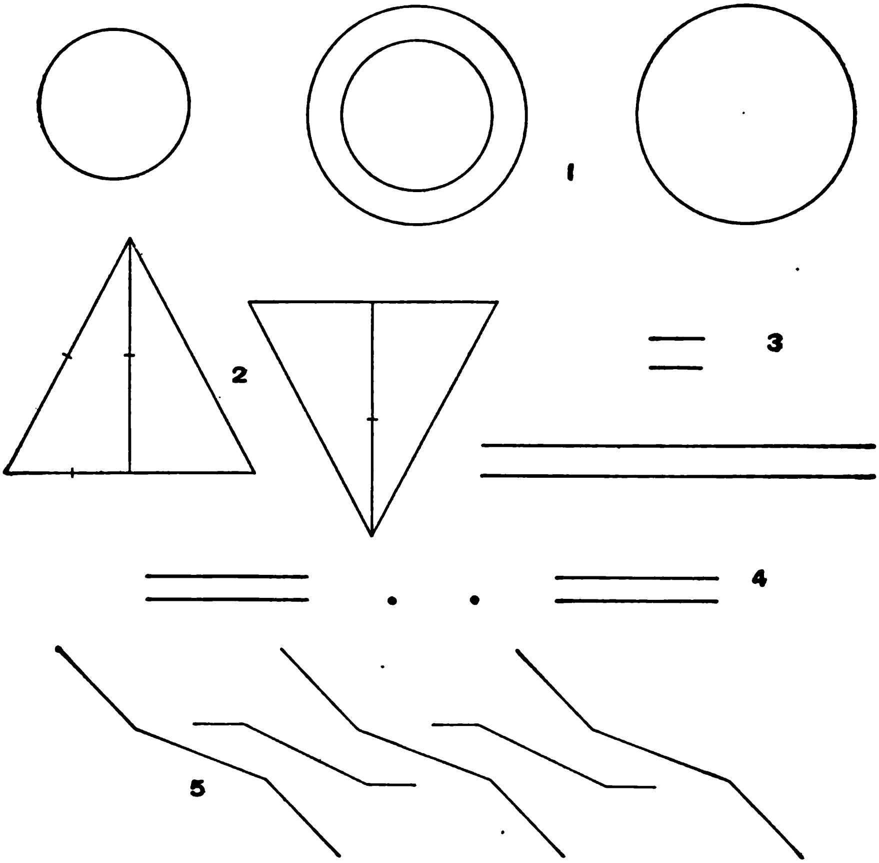

FIG. 12. MIXED ILLUSIONS (from Titchener, *Experimental Psychology*).

In 1 compare the size of left-hand circle with inner circle in middle figure, also outer circle of middle figure with right-hand circle. In 2 the half of the altitude of an equilateral triangle that is nearer the vertex looks shorter than the other half. In 3 the shorter parallel lines seem farther apart than the longer parallels do (Wundt). In 4 "the dots are really at the level of the lower line, but seem a little too high, especially when the figure is held so as to make the lines oblique" (Sanford). In 5 the middle sections of the five broken lines are all parallel, though they appear to be otherwise.

and two narrow rectangles are drawn, of equal height and separated by equal spaces, the space between the larger rectangles will look smaller than the space between the narrower; the interspaces are differently estimated by 'contrast' with the adjacent figures. (See CONTRAST.) (e) Finally, we may, of course, have figures in which several of the above-mentioned motives, physiological and psychological, coöperate to produce the illusion.

We may further include under the general heading of optical illusions: (1) the physical illusions produced by mirrors, lenses, prisms, etc. (see MIRAGE; REFLECTION; REFRACTION); (2) the physiological illusions of color (see AFTER-IMAGE; CONTRAST); (3) illusions of movement, such as, e.g. the apparent movement of the moon when viewed through drifting clouds; and (4) illusions of distance. Under the latter category falls the apparent enlargement of sun and moon when seen near the horizon. The distance between the observing eye and the horizon seems to be longer (owing to the haziness of the air, the number of intervening objects, etc.) than the distance between the eye and the zenith. But if two objects subtend the same visual angle (give the same retinal image) at different distances, the one which is farther off must be larger than the other.

Touch, no less than sight, is subject to spatial illusion. (a) If two compass points are set down upon the skin, first on an area of greater and then on an area of less sensitivity, the distance between them will seem to be greater in the former case than in the latter. Give the points, e.g. a separation that enables them to be clearly perceived as distinct impressions when they are set crosswise upon the skin of the upper arm. Now draw the compasses down the inner surface of the arm, to forearm, wrist, and finger-tips. The two parallel lines which they describe will appear to converge and diverge upon the regions of less and greater sensitivity. Or set the points down, vertically, upon the upper and lower lips, and draw the compasses outward, toward the ear. The points seem to converge as they travel over the skin. (b) Cross the tip of the second over that of the third finger, and place a marble or other small object between the crossed tips. Since the two surfaces now stimulated are never affected, in ordinary life, by one and the same object, but only by two different objects, the single marble is 'felt' as two. This illusion of localization is described by Aristotle, in his tract *On Dreams.* (c) Draw a given length of coarse thread between the finger and thumb, at first slowly, and then more quickly. The thread appears to be much longer in the former case; the separate pressure sensations have a longer time in which to run their course undisturbed by subsequent pressures, and fullness of sensation is interpreted as length of thread. (d) If a point be moved over the skin at a uniform rate, it will seem to travel more quickly as it crosses areas of greater sensitivity, and to become slow again as it enters regions of less sensitivity.

A striking illusion of temperature is described by the English philosopher Locke (q.v.). Hold the one hand in a bowl of heated, the other in a bowl of cold water. After a short time, plunge both hands into a bowl of lukewarm water. This will appear hot to the cooled, and cold to the heated hand. The illusion is due to the preceding adaptation of the temperature-organs of the skin. (See CUTANEOUS SENSATION.) An equally striking illusion in the sphere of kinæsthetic sensation is afforded by the fact that a small weight always appears heavier than a larger weight of the same objective heaviness. The smaller weight stimulates intensively a limited cutaneous area, with its underlying tissues; the larger weight stimulates lightly a large area of skin, and leaves the underlying tissues practically unaffected. These instances, which could be multiplied almost indefinitely, show clearly that the term 'illusion' implies nothing more than a discrepancy between perception and objective measurement.

BIBLIOGRAPHY. For (1), consult Wundt, *Physiologische Psychologie* (Leipzig, 1893). (See HALLUCINATION.) For (2), consult: Titchener, *Experimental Psychology* (New York, 1901); Sanford, *Course in Experimental Psychology* (Boston, 1898); Wundt, *Die geometrisch-optischen Täuschungen* (Leipzig, 1898); Lipps, *Raumæsthetik und geometrisch-optische Täuschungen* (Leipzig, 1897); James, *Principles of Psychology* (New York, 1890); Hoppe, *Psychologisch-physiologische Optik* (Leipzig, 1881).

ILLUSION COMIQUE, ē'lụ'zyôɴ' kô'mēk', L' (Fr., the comic illusion). A complicated and improbable play by Corneille (1636) embracing a comedy and a tragedy.

ILLUSIONS, OPTICAL. See ILLUSION.

ILLUSIONS PERDUES, ē'lụ'zyôɴ' pâr'dụ', LES (Fr., The Lost Illusions). A work in three parts by Balzac (1837-43), which earned the hostility of the press by reason of its picture of the feuilletonists.

ILLUSTRATED LONDON NEWS. The oldest illustrated weekly, founded in 1842, by Herbert Ingram.

ILLUSTRATION. A term generally used in reference to the pictorial decoration and illustration of books. In the more usual sense, book illustration is the addition to a book of pictures (and indirectly of maps and plans) which may aid in the right understanding of the text. This service they may render in a serious and almost scientific way by giving views of buildings, accurate drawings or other reproductions of dress, portraits of individuals, copies of works of art named, and the like, these being things which are impossible to describe in words, and of which a clear presentation to the reader is desired. On the other hand, the illustrations may also be merely extensions of the text; thus, when Cruikshank or Leech illustrates *Oliver Twist* or *Mr. Jorrock's Hunt*, the description or narrative passage of the text is in a sense repeated by the artist—a part of the story is retold in line and light and shade.

A book consisting almost entirely of pictures, or having those for its principal subject, cannot be said to be an illustrated book. Thus the volumes of the Paris *Salon*, with large photogravures of the paintings and statuary of the year with a text which is rather perfunctory, or that little volume which made the delight of schoolboys fifty years ago, *Mr. Jonathan Oldbuck*, or in more recent times, the albums of Caran D'Ache and Forain, or Howard Pyle's or T. S. Sullivant's "Fables" are of this class. In the one case the pictures are the book, and the text is not absolutely needed; in the other case the pictures and the brief legends or the re-written Æsop Fable a hundred words long, form together a humorous study of which the picture is much the more important part. This is hardly illustration. And in like manner when the pictures drawn for a book are large, and few in number, and are printed on separate plates and bound in, they have less the air of illustration, and indeed, serve less well their purpose as illustration, than those which, being smaller, are inserted in the text. The very admirable pictures by Albert Lynch given with the quarto edition of Maupassant's *Pierre et Jean*, although spoken of with great respect by excellent judges, and although admirable compositions, are yet less effective as illustrations than the less pretentious and really less able drawings by Merbach, and others which are scattered through the duodecimo volumes of Daudet's *L'Immortel* or Bourget's *Mensonges*, and immeasurably inferior to the roughly cut headpieces by Meissonier in *Les contes rémois*. From this point of view the famous 'vignettes' of the eighteenth century illustrated books are the least satisfactory of illustrations. They render, indeed, a single scene or incident of the story, but they are wholly unrealistic in character, the figures being posed without general truth of attitude or truth of gesture, and while they are attractive and instructive as works of the draughtsman and of the engraver's art, they are also models of all that is to be avoided in book illustration.

HISTORY. The history of illustration is hard to treat as a continuous narrative. The Egyptian manuscript *Books of the Dead* contain numbers of delicate and very ornamental paintings, usually of small size and combined with the text in an admirable way; and the paintings in the Ani Papyrus in the British Museum, and a few other recently discovered manuscripts, have larger drawings. On the other hand, we are without any knowledge of Greek manuscripts with drawings accompanying them. Of Roman Imperial manuscripts with illustrations there is nothing known prior to the Christian epoch; but the paintings which accompany the famous *Genesis* of the Vienna Museum and a very few contemporary books remain to us. It is the opinion of excellent critics that these monuments of a decadent epoch will mislead us, if we try to judge from them the character of work of the earlier and better times; but those who urge this may forget that one art continues to flourish while others lapse. In the fourth century sculpture had declined; but mosaic was just beginning its magnificent development, and the most startling examples of Roman vaulted construction in solid mortar masonry date also from that time. Moreover, the antique look and the pagan spirit are still to be found in the Christian illustrations of the fourth and fifth centuries, whereas the Church has had its own way with the mediæval manuscripts of the eleventh and twelfth centuries; and those of much earlier date, like the Irish and the Anglo-Saxon, are too barbaric to have any relation to this inquiry in their paintings—whatever the illuminated page may have of decorative effectiveness.

The mediæval manuscripts combine illustration by means of miniatures with the decoration of the page in a very wonderful way. (See MANUSCRIPTS, ILLUMINATION OF.) With the revival of learning in Italy, the painting of miniatures became very much more elaborate as an art, and some of these miniatures of early time are finished pictures with background, distance, and everything that a modern landscape or genre picture has, except cast shadows. Even the shadows appear toward the close of the fifteenth century, and with the shadows comes the end of illumination considered as a separate art. The famous *Breviario Grimani* is, however, without shadows, and yet is dated at the very close of the fifteenth century: and the borders which Albert Dürer drew for the margins of the printed book called *Maximilian's Prayer Book,* and which were executed in 1515, have their elaborate groups of busy little figures drawn without traceable or outlined shadows, although the figures may be partly relieved on a dark shading.

With the earliest printed books come the earliest wood-engravings, which are of exclusively artistic character. The *Hypnerotomachia* of the so-called Poliphilo (Francisco Colonna), printed in 1499, has large and very open drawings, sometimes filling nearly the whole of a small folio page. The *Epistles of Saint Jerome,* of 1497, has a great number of small illustrations, not larger than a lady's visiting card, but full of character and containing sometimes a dozen figures boldly drawn and skillfully grouped. The several illustrated editions of the *Divine Comedy* of Dante, of which perhaps the earliest is of 1497, have woodcuts and illustrations also in outline. During the next century this same tendency to simple and rather formal illustration, in outline except for some arbitrary shading, continues; and it is not to be doubted that the expectation was that hand coloring would be called in to complete these designs. Books, with their pictures elaborately colored by hand, remain to us from this epoch. In the National Library in Paris a special permanent exhibition of these is maintained. The constant reprinting of the early books tended to preserve the abstract and simple character of illustration, and it is not until the middle of the sixteenth century, with the copper engraved plates illustrating the different manuals of sword-play, and the delicate little woodcuts illustrating the Old Testament, and the "Dance of Death" ascribed to Holbein, that a freer style is introduced. Entire freedom in drawing for wood-engraving came slowly; even Albert Dürer's work is largely confined to outline, and single plates of the "Apocalypse" and the "Life of Mary" are found elaborately painted in water-color, and touched with gold. But with the last quarter of the sixteenth century complete light and shade is sought for, as in the woodcuts ascribed to Jost Amman, published by Feyerabend of Frankfort, and those of Vecellia, dated 1590. In the seventeenth century were published curious books of history and topography, sometimes adorned with crowded battle pieces, or, like the curious history of the wars between England, France, and the United Provinces, with views of sea-fights, minutely engraved on copper, and effective enough in a black and crowded way. One of these pictures shows the great fire of London in 1666, the book being printed two years later. The books published by Matthäus Merian of Frankfort with the admirable views of German cities are of this time: and Wenceslaus Hollar began his wonderful career of simple and perfect work as an engraver in Merian's employ. Book illustration was, however, feeble during the hundred years from 1650 to 1750, and the French *Livres à Vignette* mentioned above are remarkable in spite of their inadequacy as helping to restore the art. Wood-engraving was revived in the course of the eighteenth century, and as early as 1775 Thomas Bewick produced his illustrations of *Æsop's Fables,* and his natural history books, the *Quadrupeds* and the *Birds;* the little narrative drawings serving as tail-pieces to the chapters of the quadrupeds forming the most important step in book illustration which had been made for a century.

The great modern movement in book illustration begins about 1830 with the woodcuts made for French classics, such as Molière and Bernardin de Saint-Pierre; and in England with the earliest books illustrated by Cruikshank. The work of Rowlandson, ending as Cruikshank began, must have influenced him greatly at first, but Cruikshank soon worked out of the exaggerated and purely farcical manner which the earlier artist retained to his death, and became an excellent illustrator of books, keeping up his full power until an advanced age. His work exists in great abundance in woodcut, and also in a simple kind of etching, in which last process he was followed and surpassed as to technical excellence by John Leech.

For the important influence of the humorous journals, see CARICATURE. The foundation of *Punch* led to the creation of a whole school of illustrators, and Leech, as a draughtsman for wood-engraving, was the chief of Englishmen of his time, keeping up his power till his death in 1864. Richard Doyle and Hablot K. Browne were his contemporaries; Du Maurier and Charles Keene, the latter one of the greatest artists in black and white, were his successors. All these men did much work in illustrating separate books. The Frenchmen Jean François, Gigous, Tony Johannot, Sulpice Chevallier (Gavarni) were their contemporaries in the French world of books. Adolph Menzel, as being mainly a lithographer, is less obviously an illustrator of books; he is rather a painter who has made many designs to a single general theme, like the *Life of Frederick the Great*—designs which have to be published in large folios.

The book illustrations of the years since 1850 are remarkable for the introduction of photographic process prints (see Photo-Engraving); but there has been also a notable rise and decline of wood-engraving (q.v.). Colored illustrations can be produced now at reasonable cost, and some of them are of great beauty. (See Three-Color Process; Lithography.) Of decisive influence upon the development of illustration of the present day are the numerous illustrated magazines and newspapers in America and Europe. See Periodicals; Newspapers.

That form of illustration which is sometimes called Extra Illustration or Grangerism (from James Granger, died 1776, a celebrated print collector) is the insertion into a book of pictures which did not originally belong to it. Thus, a history or an historical novel may be illustrated by collecting portraits of men famous at the time dealt with in the book, and scenes of historical interest previously drawn and engraved, and these prints may be bound into the book or simply laid between its leaves. In this way a book of one volume may be extended to a dozen; and as some of the plates will be large, the smaller ones are perhaps 'inlaid,' that is, their edges fitted into a hole cut in a larger sheet of paper, while the printed leaves are treated in the same way, so that all the leaves of the enlarged book may be of the same size. This proceeding has been the cause of the destruction of many valuable books, for a whole volume will be sacrificed for the sake of its frontispiece or its illustrated title-page, or marred by the extraction from it of one or two portraits.

ILLUSTRATION, é'lu'strȧ'syôɴ', L'. An illustrated Paris weekly founded in 1843, modeled on the *Illustrated London News*.

ILLUSTRIERTE ZEITUNG, ėl'lōōs'trēr'te tsī'tōōng (Ger., illustrated news). The oldest German illustrated weekly, founded in Leipzig, by J. J. Weber, in 1843.

ILLYR'IANS (Lat. *Illyria*, from Gk. 'Ιλλύριοι, *Illyrioi*, from 'Ιλλυρίς, *Illyris*, 'Ιλλυρία, *Illyria*, Illyria). A people of doubtful ethnic kinship, who at the dawn of history inhabited the northern and eastern shores of the Adriatic and the northwestern part of modern Greece. From this latter region a migration took place at a very early period across the Ionian Sea to the southeastern corner of Italy. It seems on the whole plausible to regard the modern Albanians as the representatives of the Illyrians, both in ethnology and in language. See Albania; Albanian Language.

ILLYR'ICUM (Lat., from Gk. 'Ιλλυρικόν, *Illyrikon*, from 'Ιλλυρίς, *Illyris*, 'Ιλλυρία, *Illyria*, Illyria). The Roman name of a country whose limits in ancient times varied very considerably. In the fourth century B.C. the Illyrians inhabited the eastern coast of the Adriatic Sea and adjacent islands, with the western parts of Macedonia as far south as Epirus. Philip of Macedon conquered the country as far as the river Drilon (modern Drino), and thence arose the division into *Illyris Græca* and *Illyris Barbara*, afterwards *Romana*. The former, now Albania (q.v.), was incorporated with Macedonia. *Illyris Barbara* or *Romana* was divided into Iapydia, Liburnia, and Dalmatia. The Illyrians were much addicted to piracy, which soon brought them into collision with the Romans, who waged a successful war against the Illyrian Queen, Teuta, in B.C. 229. About B.C. 168 the southern Illyrians became subject to Rome, but the subjugation of the northern Illyrians was not effected until the time of Augustus. Under the Roman Empire the country of the Illyrians, under the name of Dalmatia (in the wider sense), formed the southern part of the diocese of Illyricum, which extended as far north as the Danube. It is represented in modern times by part of Croatia, nearly all of Bosnia, Dalmatia, Herzegovina, Montenegro, and a part of Albania. Under Constantine the prefecture of Illyricum embraced a great part of the Roman dominions in Europe east of the Adriatic. A decree of Napoleon, October 14, 1809, organized the dominion known as the Illyrian Provinces, erected out of territories taken from Austria. It comprised Carniola, part of Carinthia, most of Croatia, Dalmatia, Istria, Fiume, etc. At his fall these provinces were united as a kingdom to the Austrian Empire, and some alterations were made in its boundaries. The kingdom was divided into the two governments of Laibach and Triest, Laibach being the capital, which arrangement subsisted till 1849, when it was subdivided, for administrative purposes, into the duchies of Carinthia and Carniola, and the coast district, containing Görz and Gradisca, Istria and Triest.

ILMEN, ĭl'mĕn *or* ĕ'ly'-mā-ny'. A lake in the Russian Government of Novgorod, situated about 60 feet above the level of the Gulf of Finland (Map: Russia, D 3). Area, over 350 square miles. The banks are mostly low, and in some parts marshy. Ilmen receives many streams, and discharges its superfluous water into Lake Ladoga through the Volkhov. The fisheries of the lake are extensive, and exploited largely by artels (q.v.). There is steam navigation during the summer between Novgorod and Staraia Russa.

ILMENITE (so called from the *Ilmen* mountains in the southern Urals), or Menaccanite. A mineral with the composition $(FeTi)_2O_4$, possessing a semi-metallic lustre, and a color ranging from brown to iron-black. It occurs in scattered grains and crystals as an abundant constituent of certain igneous rocks, including basalt, diabase, and gabbro, and of magnetic iron ore. The proportion of titanium, which varies within wide limits, gives rise to a number of varieties of ilmenite, such as *kibdelophane*, *crichtonite*, *hystalite*, *mohsite*, etc. When mixed with magnetite (titaniferous iron ore) in any considerable amount it greatly lessens the value of the latter for smelting purposes. Ilmenite is found at various localities in Russia, Norway, France, in the Adirondacks of New York, in Connecticut, Massachusetts, and in Canada.

ILME'NIUM (Neo-Lat., from the *Ilmen* mountains in the southern Urals). A name given to a mixture of columbium and tantalum, which was at one time mistaken for an element.

ILOCANO, ē'lō-kä'nō. A Malay people widely spread in Northwestern Luzon, having distinctive speech, alphabet, and culture. See Philippine Islands.

ILOCOS NORTE, ē-lō'kōs nōr'tȧ. A Philippine province occupying the northwestern corner of the island of Luzon. It is bounded on the west and north by the China Sea, on the east by the provinces of Cagayán and Abra, and on the south by the latter and Ilocos Sur. Its area is 1873 square miles. It is traversed from north to south by a chain of mountains rising in Mount

Burnay to a height of 6300 feet, and covered with forests producing rich cabinet woods. As the province is exposed in winter to the north winds, its climate is more tempered, and more agreeable to foreigners than that of other parts of the island. The province is well watered, the principal river being the Pagsan or Laoag, and the valleys are very fertile, producing, besides the grains and fruits of the temperate zone, a fine quality of rice, good cotton and tobacco, and sugar. Iron ore is abundant. The *carabaos*, a species of ox or buffalo peculiar to the Philippines, is very numerous. The fisheries on the coast are also very lucrative, and on the whole the province is one of the best developed on the island. Communications are good; a high road leads through the province from Manila, and a railroad is projected from that city to Laoag (q.v.), the capital. Ilocos Norte was united with Ilocos Sur previous to 1818, when they were separated on account of their growing importance and population. Population, in 1900, 156,700.

ILOCOS SUR, sōōr. A Philippine province, situated in the northwestern part of the island of Luzon. It is bounded on the north by Ilocos Norte, on the east by Abra and Lepanto, on the south by La Unión, and on the west by the China Sea. It is a narrow strip of rather low and flat coastland with an area of 644 square miles. It is crossed by the large river Agra, and a number of smaller streams; the soil is very fertile, producing indigo, sugar, and cocoanuts, all of which are exported. There are manufactures of furniture and carriages, and the weaving of cotton textiles by the women in their homes is practiced all over the province. The towns are connected by good roads, though most of the rivers have to be forded, as there are few bridges. The high road and projected railroad from Manila to Laoag passes through the province. The population in 1900 was 172,836. The capital is Vigan (q.v.). See ILOCOS NORTE.

ILOILO, ē̆'lô-ē̆'lô. A province comprising the southern half of the island of Panay in the Philippines and about thirty, mostly small, outlying islands, one of which, however, Guimaras, is 30 miles long by 10 miles wide. The area of the province is 2600 square miles, and its population in 1900 was 472,798. It has a coast-line of 270 miles with numerous safe harbors and anchoring grounds, among which those of Iloilo and Concepcion are the most notable. The province is separated from those of Capiz and Antique on the north by a chain of rugged mountains covered with forests, from which numerous rivers and torrents flow to the sea, often bringing destructive floods. The climate, tempered by the constant monsoons, is much more moderate and far more healthful than that of Manila. The level lands, which constitute the greater part of the area of the province, are very productive, all kinds of tropical fruits flourishing; but the inhabitants are chiefly given to the cultivation of sugar and tobacco. The chief manufacturing industry is that of textiles such as homespun fabrics of sinamay, piña, jusi, etc. Commercial communication between the cities is easy and regular, the roads being generally in good condition. The greater part of the inhabitants consist of tribes of Bisayas, with many European and Chinese *Mestizos*, or half-breeds, in the cities, and a few Negritos in the mountains. The Bisayas were first converted to Christianity by the Augustine Fathers in the middle of the sixteenth century. The province suffered for a long time from the piratical Moros, and forts were built here by the Spaniards as early as 1581. In 1616 an unsuccessful attempt was made by the Dutch to capture Panay. At the end of the Spanish-American War in 1898 the natives were in complete possession of the island, and showed determined resistance to American authority. Capital, Iloilo (q.v.).

ILOILO. The capital of the Province of Iloilo (q.v.), situated on the southeastern shore of the island of Panay, on the strait separating Guimaras Island from the mainland (Map: Philippine Islands, G 9). It has an excellent harbor, and is, next to Manila, the chief commercial centre of the Philippines. Its chief exports are sugar, tobacco, rice, coffee, and dyewoods, and it supports several industrial establishments, among which are a machine-shop and a foundry. It is irregularly built, but has a number of prominent buildings, among them a cathedral, a seminary, and several Government buildings. Population, in 1898, 10,400. In February, 1899, it was bombarded and occupied by United States troops.

ILONGOS, ê-lôn'gôs. A town of the Philippine Islands. See HILONGOS.

ILONGOTE, ē̆'lôn-gō̆'tâ. A wild Malay people, of Mongoloid type, in Middle Luzon. See PHILIPPINE ISLANDS.

ILOPANGO, ē̆'lô-päŋ'gô. A lake in the Central American Republic of Salvador, situated in a fertile and beautiful plain surrounded by high hills, a short distance east of the capital (Map: Central America, C 4). Its water is saline and sulphurous and unfit to drink, though it abounds in fish. It is 10 miles long by 6 broad, and contains a number of islets, of which one was raised to about 400 feet by an eruption in 1879-80, and remains in the form of a volcanic cone.

ILORIN, ê-lō̆'rên, or **ALORI**, â-lō̆'rê. The capital of a British province of Northern Nigeria, West Africa, on the Asa, a tributary of the Niger, 170 miles northeast of Lagos (Map: Africa, E 4). Like Abeokeuta (q.v.), it was a municipal confederation of the Kingdom of Yoruba, established for mutual protection. The town is surrounded by a mud wall 12 miles in circumference, and has several mosques, Mohammedans predominating among the heterogeneous population of natives. It has an extensive caravan trade with Central Africa, and numerous local industries, including wood-carving, pottery, and leather manufactures. Population (estimated), in 1901, 50,000.

ILOW, ē̆'lô, CHRISTIAN. Baron (c.1585-1634). An Imperial general in the Thirty Years' War, born at Neumark. He fought bravely under Tilly at Stadtlohn (1623), and soon after was transferred to Wallenstein's army. He easily won the confidence of his general, and took part in the intrigues which resulted in the break between Wallenstein and the Emperor. He was assassinated at the banquet of Eger.

ILSE, êl'*ze*, PRINCESS. In German legend, the daughter of the giant of the Ilsenstein, who threw herself into the flood when parted from her lover, and was changed into a water spirit.

I'LUS (Lat., from Gk. Ἶλος). In Greek mythology, the reputed founder of Troy. He was born in Dardania, on Mount Ida, and was the son of Tros, great-grandson of Dardanus, and father of Laomedon. In an athletic contest in Phrygia he received, as the prize of victory, fifty youths and fifty maidens. In addition, at the command of the oracle, a spotted cow was given to him, and he was directed to follow her until she should lie down, and on that spot to establish a city. This spot was the hill of the Phrygian Ate, where he founded the town which from his name was called Ilios, and from the name of his father Troy. The Palladium came to him there as a sign from Zeus.

ILYA MUROMETS, ê-lyä′ mo͞o′rô-mĕts (Russ., Elijah of Murom). The favorite hero of the Russian *bylina* (q.v.), a representative of the peasant class. The strongest of the 'younger paladins,' he spent his life in guarding his country against her enemies and in protecting widows and orphans. In extreme cases only did he shed blood. Usually the foe was frightened away by the exhibition of Ilya's strength in turning some mighty oak into splinters or some similar display of prowess.

IMAGE-WORSHIP. The use, in public or private religious services, of graven or painted representations of sacred persons or things, and especially the exhibition of honor, reverence, or worship to such representations. Under the old law, because the Jews were constantly tempted by the example of the surrounding idolatrous nations, the strictures with regard to the worship of images were very severe. There were images of the cherubim placed in the Holy of Holies, however, so that such representations were not entirely forbidden. There is no mention of the use of images in public or private worship in the New Testament, nor in the chronicles of the first century of Christianity. They seem to have been introduced very early, however, for Tertullian at the beginning of the third century mentions the image of the Good Shepherd as engraved upon chalices quite as if this were and had been for a long time a common practice. Crucifixes seem to have been introduced very early; this is proved by a graffito, often supposed to be a pagan caricature of Christianity, probably of the end of the second century, scratched upon the wall of a room in the palace of the Cæsars. (See GRAFFITI.) It is a rude representation of a man standing in the attitude of prayer, with outstretched hands, before a grotesque caricature of the crucifixion, bearing the legend 'Alexamenus worships God.' The tombs of the Christians in the Roman catacombs, many of which are of a date anterior to Constantine, frequently have graven representations of the dove, of the cross, of the symbolical fish, of the ship, of Adam and Eve, of Moses striking the rock, of Jonah, of Daniel in the lions' den, of the Apostles Peter and Paul, and above all of the Good Shepherd. The chapels of the catacombs are profusely decorated with sacred representations, the age of which it is not easy to determine with accuracy, though some of them seem to come at least from the second century. After the condemnation of the Nestorian heresy in 430, statues and pictures of Christ, of the Virgin Mary, and the saints were very commonly used in public and private religious services and in churches and religious edifices. As the mass of the people became more ignorant in the sixth and seventh centuries, certain abuses with regard to the veneration of images in religious worship crept in. These led to a reaction against image-worship in the East, which culminated in the movement known as iconoclasm, because it commanded the breaking of images. The formal beginning of iconoclasm was an edict by the Emperor Leo III. (717-741), known in history as the Isaurian. The exact terms, as well as the exact date, of the edict are unknown, though Hefele places it in 726. It commanded the destruction of all pious images in public places. The removal of a famous image of Christ over the palace door caused a popular uprising in Constantinople. In Greece and Lower Italy the opposition to the edict was pronounced. The Patriarch of Constantinople refused to allow it to be put into force, and Pope Gregory II. (715-731) condemned it. Leo persisted, however, apparently influenced by the Caliph Yezid II., who set the example of destroying images in accordance with the Mohammedan religion. Saint John of Damascus (died about 760), who lived under the Caliph, wrote three discourses in defense of the use of images for religious purposes. Under Leo's successor, Constantine Copronymus, a council confirmed the Imperial edict. Leo IV. also upheld iconoclasm. Under his widow, Irene, however, the second Council of Nicæa (787) reaffirmed the orthodox views as to image-worship; but succeeding emperors, except Michael the Stammerer (820-829), who tried to effect a compromise, were iconoclasts. On February 19, 842, Theodora, widow of Theophilus (829-842), brought back the images in triumph to the Cathedral of Constantinople. This date is kept as the feast of orthodoxy. By an error the acts of the Nicene Council were sent in a garbled translation to Charlemagne. He objected to their publication in his realm in the *Libri Carolini*, now generally considered authentic, sent to Pope Hadrian I. (772-795) about 793. The Nicene Council solemnly declared that the worship to be paid to images is not true adoration, *latreia*, which is to be given to God alone, but *douleia*, or veneration. While the Greek verb *προσκυνεῖν*, 'to worship,' is used, it is explained that it is only in the sense of honoring because they represent God or His saints, and because the honor which is given to images is referred to their prototypes. When the error of translation was explained, the misunderstanding ceased to exist. The Council of Trent reaffirmed the declarations and distinctions of the second Nicene Council as to image-worship, adding that there is "no virtue in images themselves on account of which they are to be worshiped; that no petition can be addressed to them; and that no trust is to be placed in them." The council advocates the true use of images, however, contending that they are of great advantage especially for the rude and unlearned, for whom they serve as memorials of the sufferings and of the mercy of Christ, as instructive records of the virtues of the saints, and exhortations to the imitation of their example and as incentives to the love of God and to the practice of piety. In certain parts of the world there are in Roman Catholic churches images for which there is a special veneration. It is well understood that it is not because any virtue resides in the image itself that it is believed that prayers are more frequently heard when said before it, but because of the special faith and fervor awakened by the traditions attached to it, and the recorded examples of the effect of the mercy of God with which it is associated in the minds of the faithful. In the Eastern churches, especially the Russian, great reverence is paid to printed pictures of the saints, or representations in relief, called icons. Every house has one or more; and in the churches the iconostasis or screen which separates the sanctuary from the body of the church is covered with them. Statues, except of the angels, are not used.

The Reformers generally rejected the use of images as an unscriptural novelty, and stigmatized the Catholic practice as superstitious, or even idolatrous. The Zwinglian and subsequently the Calvinistic churches absolutely and entirely repudiated all use of images for the purpose of worship. Luther, on the contrary, while he condemned the Roman worship of images, regarded the simple use of them, even in the church for the purpose of instruction and as incentive to faith and devotion, as one of those indifferent things which may be permitted, although not of necessary institution. In the Lutheran churches of Germany and the northern kingdoms, pictures, crucifixes, and religious emblems are still freely retained. In all wholly Protestant communions images are entirely unknown, although their use has been freely revived in the Anglican communion of late years. Consult: Lüdtke, *Die Bilderverehrung und bildlichen Darstellungen in den ersten christlichen Jahrhunderten* (Freiburg, 1874); Hefele, *Conciliengeschichte* (7 vols., ib., 1854-71); Kraus, *Roma sotterranea* (ib., 1879).

IMAGINARY POINTS AND LINES. In analytic geometry, a point is said to be imaginary if one or more of its coördinates are imaginary. E.g. the points of intersection of the straight line $x = 6$ and the circle $x^2 + y^2 = 4$, found by solving the two equations, are $x = 6$, $y = 4\sqrt{-2}$, and $x = 6$, $y = -4\sqrt{-2}$, the two values of y (i.e. the ordinates of the points) being imaginary, the points of intersection of the given line and circle are said to be imaginary. Similarly, the conjugate axis of the hyperbola (q.v.) cuts the hyperbola in two imaginary points. A line whose equation contains imaginary coefficients is called an imaginary line. E.g. the asymptotes of an ellipse or circle are imaginary lines. Their equations may be obtained from the equations of the curves thus: Let $x^2 + y^2 = 0$, then $(x + yi)(x - yi) = 0$, and $x + yi = 0$, $x - yi = 0$ are the imaginary asymptotes to the circle. Similarly,

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 0,$$

then

$$\left(\frac{x}{a} + \frac{y}{b}i\right)\left(\frac{x}{a} - \frac{y}{b}i\right) = 0;$$

and

$$\frac{x}{a} + \frac{y}{b}i = 0, \frac{x}{a} - \frac{y}{b}i = 0,$$

are the imaginary asymptotes to the ellipse. All of these imaginary lines have the real point $x = 0$, $y = 0$. See CONTINUITY.

IMAGINARY QUANTITY. See COMPLEX NUMBER.

IMAGINATION (from Lat. *imaginatio*, from *imaginari*, to imagine, from *imago*, image). Taken in its broadest significance, thinking in images. In this sense it is synonymous with phantasy. Thus one may imagine a mountain, the sound of flowing water, the fatigue of a long journey, the rhythmic march of an army, or the articulatory 'feel' of a word in the throat. The power to image, to imagine, is dependent, first of all, upon past experience. An individual born blind never has visual images; one born deaf never hears words 'ringing in his head.' Moreover, the ability to image varies greatly from individual to individual. Visual images predominate in one mind, auditory in another, tactual or motor in a third. See MEMORY.

In a more restricted sense, imagination covers a single class of mental images. In this significance, 'an imagination' is coördinate with a 'memory image' or an 'expectation image.' Taken as clusters of sensations, these three classes of images are identical. They differ only in their reference and in their setting. A memory image refers to some part of one's past experience (one has a visual image of one's childhood home, or an auditory image of a familiar piece of music). Its function is to 'reproduce' the past. Similarly, expectation images are set within the individual's experience, but within the part that exists only in anticipation. Their function is to connect the present with the future. Finally, an imagination has no direct connection with the course of one's personal experience. As one reads a volume of fiction, one may imagine scenes, voices, movements, situations. The whole narrative is held together by a succession of imaginations, or 'imagination images,' as they might be called. This is passive or reproductive imagination. Over against it stands active or constructive imagination, an instance of which is furnished by the artistic productions of the painter and the sculptor. Between passive and active imagination there exists the same difference as between musing and 'hard thinking.' In the passive type there is a nucleus—e.g. the text of the novel—about which are clustered various near-lying associations; in the active type, images, more or less discrete and unrelated, are brought together and wrought into a systematic whole. The difference is rather one of degree than of kind. Active imaginations show greater selectiveness; a disjunction of elements succeeded by an aggregation of those most fit to express some feeling or idea. This is evident in a painting of natural scenery, where the artist has modified nature to suit his purposes.

James Mill and Bain confine imagination to those constructions which are produced under the influence of emotion—e.g. ghosts and hobgoblins evoked by terror, or the creations of the poet and the musician. Sully, on the other hand, makes it cover three distinct forms of mental construction — cognitive imagination, practical imagination (or invention), and æsthetic (or poetic) imagination.

Consult: Bain, *The Senses and the Intellect* (London, 1888); James, *Principles of Psychology*, vol. ii. (New York, 1890); Sully, *Outlines of Psychology* (New York, 1891); Ambrosi, *Psicologia dell' immaginazione* (Rome, 1898); Hoefler, *Psychologie* (Vienna, 1897).

IMA'GO. The adult, sexually mature form of an insect which passes through metamorphoses. See METAMORPHOSIS.

IMAM, ê-mäm' (Ar. *'imâm*, leader, from *'amma*, to lead, set an example). The appellation given in general to teachers among the Mohammedans, as leaders whose example is to be followed. It is commonly employed to designate any of the persons belonging to the Mohammedan ulema (q.v.) or 'learned' body. They are distinguished from the laity by a turban somewhat higher than usual, and are held in great reverence by the people. Besides this general use, there are also certain specific applications of the term. Among the Shiites (i.e. the followers of Ali) the term imam is applied to the twelve legitimate successors of Ali. Among the orthodox Mohammedans the imam is properly the caliph, or leader of the entire body of Mohammedans, but the name is also extended to any authority whose views on theology and law are followed. In the course of time every Mohammedan community came to have its imam, whose chief function it was to lead the congregation in prayer. He takes his stand in front of the group of worshipers, who take up a position behind him arranged in fixed rows and imitate the genuflections and attitudes assumed by the leader in the course of the prescribed prayers.

IMAMITES, ē-mäm'īts. A Mohammedan sect whose members recognize the twelve imams, descendants of Mohammed's son-in-law Ali, whom they consider the first real imam or caliph. They are commonly known as Shiites.

IMAZIGHEN, ē'mȧ'zē'gäN'. The designation of all the Berber tribes of the Atlas Mountains, in Algeria and Morocco, comprising the Kabyles, Shulluhs, and Haratin. The Kabyles, who call themselves Imazighen, are furthest north, and more mixed with Semites and Europeans; the Shulluhs (Shluhs) are to be found on the northward sloping valleys of the Atlas Mountains, while the Haratin Berbers are on the southern slopes and mixed with negroes. (See Kabyle; Shulluhs; Haratin.) They are Hamites fundamentally in blood, but have long been accultured with Arab speech and religion. Their mountain retreats have enabled the Imazighen Berbers to preserve their ancient patriarchal mode of life, so that many hundreds of clans and families keep up their small organizations at the same time that they are united into larger nations. A similar social structure existed in America, where, within the powerful confederacies and nations of Indians, were innumerable minor divisions.

IMBATTLED. See Embattled.

IMBECILITY (from Lat. *imbecillitas*, weakness, from *imbecillus*, weak). (1) Mental weakness or defect. Imbecility and idiocy are comparative terms. They are both states due to similar processes, consisting of imperfect development of the brain, and due to congenital influences or acquired injury or disease. (See Idiocy.) Thus it is almost impossible to determine the dividing line that separates an idiot from an imbecile, and such differentiation may entail much study and careful following of the mental development. In general understanding, an idiot is unable to attend to the simple primary affairs of his organization. An imbecile is able to attend to these. At the other end of the scale the imbecile shades into the normal average human mind by imperceptible gradations, and it may be just as difficult to separate the imbecile from weak-minded, dull, and stupid individuals as it is to separate the idiots from imbeciles. There are large numbers of weak-minded, useless persons in every community who differ from the more robust intellects solely in degree. But the more marked and recognizable imbecility is characterized by many of the following signs: The vacant expression, dull senses, small head, deformed body, vacillating and restless gait; pendent, thrown back, or agitated head; escaping saliva, limited and infantile language. The ideas may be few, and consist of mere sensuous impressions; the temper, timid, facile, and vain; and the passions are little susceptible of control. The affection has been regarded as general, or involving the whole mind; or as partial, when the intellect only, or the sentiments only, or a particular faculty, may be feeble and ineducable.

(2) As a generic legal term, a weakness of mind falling short of idiocy (q.v.) on the one hand and full mental capacity to contract or to distinguish between right and wrong on the other. The victim of imbecility, using the word in this sense, is not absolutely incapable of binding himself by contract or of committing crime. If his weakness is taken advantage of by another, any contract or conveyance so secured may be set aside, but the mere fact that a man is of weak understanding, or that his intellectual capacity is below the average of mankind, if no fraud, or no undue advantage be taken, is not of itself an adequate ground to set aside a transaction. It should be added that a lower degree of intelligence is required for a valid will than a business contract or conveyance. In various jurisdictions imbeciles are more or less protected against the fraud of others or their own acts of indiscretion by placing them more or less under the control of others, as in Scotland by interdiction, or by the appointment of a committee or guardian. See Interdiction; Committee; Guardian; also see Idiocy; Insanity; Lunacy; and the authorities there referred to.

IMBER, Naphtali Herz (1856—). A Hebrew poet and Cabbalist, born of poor parentage at Flochow in Galicia. He received a thorough training in the Talmud, and after the age of fourteen led the life of a wandering scholar, visiting in turn Constantinople, Egypt, and Palestine. There he studied the Oriental languages, and especially Hebrew. From Palestine he went to England, where he worked for some time in collaboration with Israel Zangwill. In 1892 he came to America, and made his home at different times in New York City, Boston, Chicago, San Francisco, and Los Angeles. In addition to many volumes of poetry and Cabbalistic lore, he wrote extensively for the Hebrew press. In his mastery of the ancient language of the Bible he takes rank with the leading scholars of Europe and America. His poetical works in form and thought are modeled to a great extent upon the songs of Judah Halévy (q.v.), whose fervent love for and hope in Zion Imber more than echoes. Among his works are: *Austria*, a poem; *The Mystery of the Golden Calf; The Keynote to Mystic Science; The Treasures of Ancient Jerusalem; The Letters of Rabbi Akibah; The Education of the Talmud*, printed by the United States Government; *Music of the Psalms*. His "Hope of Zion" has become the hymn of the Zionist party the world over.

IMBERT DE SAINT-AMAND, ăN'bâr' de săN'tȧ'mäN', Arthur Léon, Baron (1834-1900).

A French author, born in Paris. He was privately educated, studied law, and after being admitted to practice entered the Government service in the Department of Foreign Affairs. Here he rose through the several ranks to the grade of Minister Plenipotentiary of the first class in 1882, and was assigned to special service in the central offices of the department in Paris. He is best known as the author of an interesting and popular series of biographical and social studies of the women of the French courts. The first of these, entitled *Les femmes de Versailles* (5 vols., 1875-79), covered the period from Louis XIV. to the close of the *ancien régime;* the second, *Les femmes des Tuileries* (37 vols., 1880-99), began with the last days of Marie Antoinette and concluded with the women of the Second Empire. The series has been translated into English under the title of *Women of the French Court*. Among his other published works, some of which have also been translated into English, are: *Portraits de femmes françaises du XVIII. et du XIX. siècle* (1869)*; Les femmes de la cour des derniers Valois* (1872); *Madame de Girardin* (1874); *Portraits de grandes dames* (1875); *La cour de Louis XVIII.* (1891); *La cour de Charles X.* (1891).

IMBIBITION (from Lat. *imbibere*, to drink in, from *in*, in + *bibere*, for **pibere*, to drink, Skt. *pā*, to drink, OIr. *ibim*, I drink). The physical process of swelling of solids by the absorption of liquid. It is exhibited most freely by organized bodies, i.e. those formed by living beings, which have therefore a characteristic structure, but is not confined to them. The swelling depends on a separation of the structural units of the body, which are believed to be not its molecules, but rather molecular complexes. Imbibition, therefore, differs from solution in that the separation of the particles is not so extensive, and when the water is removed by evaporation or otherwise they return to their original relations, so that the body regains its previous form and structure. After solution, on the contrary, the separated molecules may rearrange themselves completely. In a normal condition all parts of plants hold large quantities of water imbibed in their substance. Even in the walls of wood-cells, the least watery material, there is usually 50 per cent. of water, while in the protoplasm there may be as much as 95 per cent. Indeed, the plant may be considered as a mass of water held between the structural particles of the cells composing it and exceeding in volume the material by which it is so held. This condition alone makes it possible for plants to obtain materials from the water and air about them. See ABSORPTION, IN PLANTS.

The force of imbibition depends upon the surface tension of the water and upon the relation between the molecules of water and those particles of the swelling body whose cohesion is thereby overcome. When a dry starch-grain imbibes water, heat is developed (on account of the compression of the water) to an amount which indicates (according to Rodewald) a pressure of over 2500 atmospheres. The force exerted by a confined swelling body is at first enormous, but becomes rapidly weaker as the particles are separated farther and farther. Correspondingly, water is held loosely when abundant, but more and more tenaciously when only a little is imbibed. Thus, when a bit of laminaria is completely swollen, water can be removed from it by slight pressure; when it holds 170 per cent. of water it requires a pressure of 16 atmospheres to extract water; when only 93 per cent. is present a pressure of 200 atmospheres is needed. Applications of the force of swelling are made in splitting stone by wooden wedges driven in and then wetted; in shortening ropes by wetting; in the use of laminaria for surgical distension, etc. The phenomena of imbibition afford the chief basis for theories concerning the molecular structure of organized bodies. See COLLOIDS.

IMBRIANI, ēm′brē-ä′nē, VITTORIO (1840-86). An Italian poet and critic, born in Naples. He pursued studies in the universities of Naples, Zürich, and Berlin, and took part in the campaigns of 1859 and 1866. In 1884 he was appointed to the chair of æsthetics at the university of his native city, but was then too ill to assume the duties of this post. His political life was a troublous one by reason of his excessively passionate nature, which was ever exciting the bitterest antagonism. As a littérateur he is best known for his collections of popular tales and verse, such as *Canti popolari delle provincie meridionali* (1871-72); *Dodici canti pomiglianesi* (1876); *La novellaja fiorentina* (1877), etc. A number of his poems are to be found in a collection entitled *Esercizj di prosodia* (1874). Among his critical works are some monographs on Dante and the *Fame usurpate* (1877), in which he seeks to demonstrate that Goethe's *Faust* is a production devoid of all merit.

IMBRICATED SNOUT-BEETLE. A very injurious weevil (*Epicærus imbricatus*), which damages many different kinds of garden vegetables and fruits, such as onions, radishes, cabbages, beans, watermelons, cucumbers, corn, beets, and strawberries, by sucking the juices of the leaves, stems, roots, or fruit. It also punctures the leaves and twigs of the apple and pear. The life-history is not thoroughly known, although the eggs and young larvæ found on the leaves of the strawberry have been described by Chittenden. The best remedy consists in spraying with a Paris green or some other standard mixture.

IMBROS, ēm′brŏs. A Turkish island in the Ægean Sea, situated about 13 miles northeast of Lemnos. Area, about 100 square miles. It is of volcanic origin, rocky and mostly barren, only a small part of its area being cultivable. Population, over 9000, mostly Greeks, engaged in fishing. The chief town is Kastron (Castro), the seat of a Greek metropolitan.

IMER, ē′mâr′, EDOUARD (1820-81). A French painter, born at Avignon. Though he received no regular instruction, he became an excellent landscape painter, particularly of scenery in Middle France. His Eastern pictures are also well known. Among his works are: "Sycamores at Gizeh;" "Island of Philæ" (1857); "Ruins of Crozant;" and "Oak Tree of Voulliers" (1873).

IMERITIA, ē′mē-rĭsh′ĭ-ȧ. Formerly an independent kingdom in Georgia (q.v.), now constituting a part of the Government of Kutais (q.v.) in Russian Transcaucasia. Its history as an independent country begins toward the end of the fifteenth century. About 1750 it was occupied by the Turks, who were expelled by the Russians in 1769. In 1810 it was annexed to Russia. The Imers, or Imeritians, who number less than half a million, are one of the tribes belonging to the southern or Georgian group of peoples of the Caucasus. They are considered by Pantiukhoff to be the purest representatives of the primitive Georgian type. See GEORGIANS.

IMHOFF, êm′hôf, AMALIE VON. See HELVIG.

IMHOFFER, êm′hôf-ĕr, GUSTAV MELCHIOR (1593-1651). An Austrian Jesuit, famed as a South American explorer. He was born near Gratz, Styria, and went to Peru as a missionary in 1624. Twelve years afterwards he crossed the Andes to the source of the Amazon, and was the first European to leave upon record his exploration of that stream to its mouth. His account was published in two volumes in Madrid (1640) and in London (1689), the latter edition called *A Relation of a Journey Along the River Amazon.* Father Imhoffer was head of the Jesuit College at Bahia, and the author of several treatises upon the language, history, and customs of his adopted country that were published by the Society of Jesus twenty years after his death.

IMHOOF-BLUMER, êm′hōf blōō′mẽr, FRIEDRICH (1838—). A German numismatist, known as an authority on Greek coins. He was born at Winterthur, became interested in numismatics when he was a boy, gave up the business career planned for him, received a classical education, and amassed a valuable collection of more than twenty thousand ancient Greek coins, bought in 1900 by the Royal Numismatic Cabinet in Berlin. The great work of the Prussian Academy of Science, *Die antiken Münzen Nordgriechenlands* (1899 sqq.), was undertaken at his instance; and in 1901 he gave to the Academy the sum of one hundred thousand francs for the promotion of the science. He wrote: *Zur Münzkunde und Paläographie Böotiens* (1871); *Die Münzen Akarnaniens* (1878); *Porträtköpfe auf römischen Münzen* (2d ed. 1893); *Porträtköpfe auf antiken Münzen hellenischer und hellenisierter Völker* (1885); *Zur Münzkunde Grossgriechenlands* (1886); *Tier- und Pflanzenbilder auf Münzen und Gemmen*, with Keller (1889); *Lydische Stadtmünzen* (1897); and *Kleinasiatische Münzen* (1901 sqq.), as well as the great illustrated works, *Monnaies grecques* (1883) and *Griechische Münzen* (1890).

IMHOTEP, êm-hō′tĕp. An Egyptian divinity, identified with Æsculapius; the son of Ptah and Sekhmet, who with Imhotep formed the triad chiefly honored at Memphis.

IMITATION (Lat. *imitatio*, from *imitari*, to imitate). The repetition of any thought or act, or the copying of any example or model. The example or model is a stimulus which sets up nervous reactions that result in more or less nearly perfect repetition or duplication. The repetition may be by one's self of one's own thoughts or acts, as when a child, having learned to pronounce a new word, says it over and over; or it may be repetition by one person of the example or copy set by any other person. Imitation may further be subconscious, and due largely to suggestion, as it sometimes is in the behavior of crowds, or it may be clearly conscious, as it is in learning to write or to draw. The phenomena of imitation are of great importance in education, in the theory of art, in ethnology, and in sociology. Froebel and Preyer especially have treated of the educational aspects. The discussion of imitation in art dates from Aristotle. In ethnology imitation is the key to an understanding of magic and primitive religion. The savage believes that he can reproduce or control desirable conditions by imitating them. In fishing he puts a bit of wood cut in imitation of a fish into the stream, to attract the fish that he would catch. In hunting he dresses in imitation of his prey. To his enemy he aims to bring death by sticking an image of him full of thorns, or by filling it with poison. The whole investigation and literature of this subject the reader will find opened to him in Skeat's *Malay Magic* and Frazer's *The Golden Bough.* Imitation as a social fact was shrewdly commented on by Bacon in the essays, but the first writer to deal with it in a systematic way was Bagehot in his most thoughtful and suggestive *Physics and Politics.* The 'crust of custom,' which characterizes primitive and unprogressive communities, was shown to be the product of imitation. The most profound study of imitation, however, is Gabriel Tarde's great work, *Les lois de l'imitation.* Tarde finds in imitation the elementary and fundamental social fact, and he makes it therefore the basis of a system of sociology. Imitations he classes as 'custom' imitations, in which the copy is ancient or even immemorial, and 'mode' or fashion imitations, in which the copy is new. Imitations extend from above (the higher social or intellectual ranks) downward, and all imitations tend to spread in a geometrical progression. One imitation may, however, interfere with another. In the resulting duel, if one does not extinguish the other, they combine, each modifying the other, and so creating a new model to be imitated. All 'inventions' Tarde thus explains as a product of the conflict of imitations. Thus by imitations and their product, inventions, he tries to account for all the phenomena of language, manners, costume, amusement, art, religion, science, economy, morals, law, and politics. All modern civilization, he avers, is but the continuing imitation of Greece and Rome. The chief criticism to be made of Tarde's theory is that it fails to take account of original similarities of activity in the universe. Not all resembling phenomena are alike merely because they form a sequence. They may be simultaneously alike, as a part of coexistence. Therefore, another system of sociology is possible, which builds upon the simultaneous like responses of like organisms to the same stimulus. See SOCIOLOGY.

IMITATION. In the science of musical composition, the repetition of the same passage, or the following of a passage with a similar one, in one or more of the other parts or voices. It may be either strict or free. When the imitated passage is repeated note for note, and every interval is the same, it is called strict, and it may take place in the unison or octave, or in any other of the degrees of the scale, either above or below the original passage. The progression of a passage may also be imitated by an inversion, or by reversing the movement of the original; also by notes of a greater or of a lesser value. (See CANON; COUNTERPOINT; FUGUE.) Imitation in composition is one of the most important means of producing unity and animation in the progression of the parts, and is used in a strict and also in a free manner, in the instrumental works of Haydn and Beethoven, and also by Mozart in his earlier operatic works. Many composers, however, resort to imitation improperly, either from poverty of musical ideas or from pedantry. In the works of the contrapuntal writers of the Netherlands examples of retrograde imitation are found. This is hardly legitimate art.

IMITATION OF CHRIST (Lat. *De Imitatione Christi*). The most widely read, after the Bible, of all spiritual books. It is a series of counsels for the attainment of perfection, written in a spirit of sincere and humble piety, interspersed with prayers and colloquies between Christ and the devout soul. It is strange that the authorship of a book so popular and comparatively so recent should have been the subject of one of the most curious controversies in literary history. Following his own counsels of humility, the author concealed his name. The oldest certainly dated manuscripts—the Wolfenbüttel (1424), the Gaesdonck (1427), and the Roolf (1431)—are all anonymous. The book was attributed with more or less positiveness to as many as thirty-five different authors, including Saint Bernard, Innocent III., and John Scotus Erigena. The choice finally narrowed to three—Thomas à Kempis, the great Chancellor Gerson (q.v.), and a person of the name of John Gersen, a Benedictine abbot of Vercelli. Most of the fifteenth century printed copies bear the Chancellor's name; but the proportion alters in the sixteenth, and the claimant Gersen or Gesen appears for the first time in 1604. The controversy raged acrimoniously in religious orders, universities, and even the Parliament of Paris. Between 1615 and 1837 no less than 150 works devoted to the question appeared in France alone. The weight of evidence, both internal and external, has for a long time been considered to rest on the side of Thomas à Kempis (q.v.). The book was finished in 1421, and first printed at Augsburg probably between 1470 and 1472. The best critical edition of the text is by C. Hirsche (Berlin, 1874; 2d ed. 1891). Consult: Kettlewell, *The Authorship of the De Imitatione Christi* (London, 1777); Malou, *Recherches historiques et critiques sur le véritable auteur du livre de l'Imitation* (3d ed., Louvain, 1858); Wheatley, *The Story of the Imitatio Christi* (London, 1891); and an excellent bibliography by a learned modern defender of the Gersen theory, Wolfsgruber, in *Giovanni Gersen, sein Leben und sein Werk De Imitatione Christi* (Augsburg, 1880).

IMITATIVE INSANITY, Induced Mania, Insanity by Imitation. These old terms were adopted upon a mistaken notion. It has been supposed that sane people became insane through imitation of maniacs, through too constant intercourse with them, or through the efforts of a strong imagination in the sane. This is untrue. The physicians or nurses who become insane while living in institutions for those of unsound mind are affected because of stress of over-work or alcoholism, or other debilitating cause which would have been operative had they been engaged in other vocations. Insane people are imitative. Frequently cases occur in a family in which a sister, previously unsuspected of being insane, betrays the delusions and adopts the obsessions of an avowedly maniacal sister. This is called *folie à deux*, or 'communicated insanity.' The insanity exists first, and then the imitation occurs. Imitation of crimes upon reading of them or seeing them committed is due to idiocy (q.v.) or hysteria (q.v.) in most cases.

IM'LAC. A character in Dr. Johnson's *Rasselas*. He is the companion of Rasselas in his wanderings, and returns with him to the happy valley.

IMMACULATE CONCEPTION OF THE VIRGIN MARY. A dogma of the Roman Catholic Church, promulgated by Pope Pius IX. in 1854. It declares that the "doctrine which holds the blessed Virgin Mary, from the first instant of her conception, to have been kept free from all stain of original sin, by the singular grace and privilege of Almighty God, in view of the merits of Christ Jesus the Saviour of mankind, is revealed by God, and therefore firmly and constantly to be believed by all the faithful."

Previous to 1854 Roman Catholic theologians had commonly believed in the immaculate conception, but it was held only as a 'pious opinion,' not as a dogma. Its history may be traced from early times, and shows gradual enlargements. The New Testament is silent on the subject of Mary's conception. In the ancient Church many persons believed in her perpetual virginity, and this found expression in some of the apocryphal Gospels. Belief seems next to have advanced to her sinlessness after the birth of Christ, then to sinlessness from her own birth, and finally to the idea that she was sinless from her very conception; Roman Catholics believe that the modern definition involves its having been held, at least implicitly, from the first. The fact that Mohammed seems to have known of these Christian tenets (cf. *Koran*, Sura, iii.) is an indication that they were widespread among the Asiatic churches at an early date. The Eastern Church, however, has not formulated the dogma, and to this day the immaculate conception remains only a pious opinion in that great branch of Christendom. In the West the history of the doctrine is closely associated with that of the feast. An effort was made in Lyons, in 1139, to introduce the festival of the Immaculate Conception, but it met with pronounced opposition from Bernard of Clairvaux, who did not accept the doctrine exactly as generally explained, and urged that the feast had not received official sanction from Rome. A prolonged controversy broke out early in the fourteenth century, which rather involved a minute technical point of the exact moment of her sanctification than the absolute acceptance or rejection of the main doctrine. The Schoolmen took opposite sides, Duns Scotus and the Scotists maintaining the doctrine in its exactness, while the Thomists, following their leader, Thomas Aquinas, opposed it. The dispute extended to the two great mendicant orders. Scotus was a Franciscan, Thomas a Dominican. The Franciscans accordingly sided with the Scotists in supporting the doctrine: the Dominicans sided with the Thomists in opposing it. There were keen debates, and mutual charges of heresy. The influential University of Paris at first sided with the Dominicans and Thomists, but afterwards its position was reversed, and by the end of the fifteenth century it required from every candidate for its doctorate an oath to defend the truth of the immaculate conception wherever it was denied. Among many other forces which worked toward the same end, we may mention the favorable action of the Council of Basel (1439), the pronouncements of Pope Sixtus IV.

(especially his constitution *Grave nimis*, in 1483), the decrees of Trent, excepting Mary from the universal curse of original sin (Session V. 1546), and the strong support of the Society of Jesus (e.g. in the person of Bellarmine). In 1622 Pope Gregory XV. forbade any one (with the conspicuous exception of the Dominicans, and these only in discussions among themselves) to teach that the Virgin Mary was stained by original sin. About forty years later (1661) Alexander VII. set forth the belief of the Church in terms very like those of the decree of 1854. Yet in spite of the general acceptance of the doctrine, the most that could be said for it down to modern times was what Benedict XIV. cautiously affirmed, about the middle of the eighteenth century: "The Church inclines to the opinion of the immaculate conception."

Pius IX. was assiduously devoted to the cult of the Virgin. In 1849 he addressed a circular letter to the bishops, inviting their opinions on the advisability of defining the dogma of her immaculate conception. Out of some 600 replies, the great majority favored the proposed action. Four opposed it. Several influential bishops, especially in Germany and France, deemed it inopportune, inexpedient, and possibly injurious to the Church. In view of the generally favorable sentiment, however, the Pope proceeded to promulgate the dogma, as stated above. The decree was read in the presence of about 200 cardinals, archbishops, and bishops, assembled in Saint Peter's, on December 8, 1854, the Feast of the Immaculate Conception. Although not a conciliar decision, it has binding force for the whole Roman Catholic world.

In explanation of the dogma, Catholic writers sometimes quote from a sermon by Bossuet, delivered on a Feast of the Immaculate Conception, in which he thus addresses Christ: "Thou art innocent by nature, Mary only by grace; Thou by excellence, she only by privilege; Thou as Redeemer, she as the first of those whom Thy precious blood hath purified." The Catholic interpretation of the matter is clearly implied in these few words. For Roman theologians distinguish between 'active' and 'passive' conception. The former is the physical act of the parents, and so far as this is concerned, Mary is held to have been conceived like other mortals. The latter is the divine infusion of the rational soul (on the theory of creationism), and this, in the case of Mary, is held to have been accompanied by a special gift of grace, whereby she differs from all other mortals. She was sanctified, and therefore sinless, from the beginning. But this was through the merits of the Son who was to be born from her, not through independent merits of her own. In this way the Church believes that it solves the two main problems raised by the doctrine of the immaculate conception, first, how it affects the Virgin Mary in her relation to the rest of the human race, and, secondly, how it affects her in relation to Christ. See Gen. iii. 15; Luke i. 28, 42.

The Feast of the Immaculate Conception, in the Roman calendar, falls on December 8th; in the Greek calendar, on the day following.

Consult: Passaglia, *De Immaculato Deiparæ Semper Virginis Conceptu* (3 vols., Rome, 1854 seq.); Ullathorne, *The Immaculate Conception of the Mother of God* (London, 1855); Wetzer and Welte, *Kirchenlexikon*, iv. (Freiburg, 1886); Addis and Arnold, *Catholic Dictionary*, art. "Immaculate Conception" (London, 1884). On the Protestant side, consult: Schaff, *Creeds of Christendom* (New York, 1877), which gives the history of the doctrine, and the Latin and English text of the constitution *Ineffabilis Deus*.

IMMANUEL. See EMMANUEL.

IM'MERMANN, KARL (1796-1840). A German dramatist, born in Magdeburg, April 24, 1796. From a school in Magdeburg Immermann went in 1813 to the University of Halle to study law, but he interrupted his studies in order to take part in the War of Liberation. Disabled by a nervous disorder, he left the field in 1815 and returned to Halle, where he was soon embroiled with other students on account of the terrorism exercised by the students' unions. He entered the Government service and in 1823 became a judge. He had become widely known as a dramatist when, in 1835, he took charge of the Düsseldorf theatre, which he developed artistically, but the theatre failed, and he became a judge again. Immermann died August 25, 1840. His plays were strongly influenced by Shakespeare. Among his best pieces are *Das Trauerspiel in Tirol* (1827) and *Merlin* (1831). Two representative novels are *Die Epigonen* (1835), an echo of *Wilhelm Meister*, and *Münchhausen* (1838-39), in which the village life of Westphalia is imaginatively described. In *Münchhausen* Poe may have found a hint for *The Fall of the House of Usher*. Immermann's *Collected Works* appeared at Düsseldorf in 1835-43, and a new edition, with *Biography and Introduction*, came out in twenty volumes at Berlin in 1883. Consult Putlitz, *Karl Immermann, sein Leben und Werke* (Berlin, 1870).

IMMERSION. See BAPTISM.

IMMIGRATION (from Lat. *immigrare*, to remove into, from *in*, in + *migrare*, to migrate). In its broadest sense, the transfer of residence from one country to another, viewed from the standpoint of the country in which the new residence is taken. The causes of this phenomenon have been discussed in the article devoted to emigration, which treated the movement at its source. We are concerned here with the effect of these movements on the countries which receive the newcomers. The invasion of the immigrant is the movement of the individual who seeks to improve his condition by a change of residence, who submits to the political institutions of the land of his adoption, and whose coming thither is frequently openly encouraged, or, at least, not actually opposed, by the country in which he settles.

Immigration and colonization are intimately related. When a new country is to be developed and its resources increased by human labor, immigration is encouraged by its authorities, and every gain in population is deemed an economic advantage. It has been in such countries in the past century into which the flow of emigration from Europe has been poured. They are Australia, South America, Canada, and the United States, in each of which immigration has raised diverse social and economic questions which must be individually studied and do not lend themselves to a general treatment. Before turning to the United States, where the immigration problem is perhaps the most acute, we may briefly consider the facts connected with immigration in other countries.

Australia. The Australian Commonwealth owes its origin to the penal settlement established there by Great Britain at the close of the eighteenth century, to which a considerable number of convicts were deported until the middle of the last century, when, at the earnest solicitation of the colonials, the system was abandoned. Efforts were made by the Government to send out free colonists to Australia, but, despite the liberal assistance of the Government, the total population by 1851 was only 430,596. Following the discovery of gold in 1850, the population increased three-fold in the next ten years, and considerable increments have been made to it at each subsequent census.

The following table gives the increase of population ascribed to the excess of immigration over emigration from 1851 to 1889 in four decennial periods and for the nine years ending in 1899:

1851-1860	618,253
1861-1870	291,342
1871-1880	336,297
1881-1890	386,018
1891-1899	61,824

The colonies showed great variations from year to year, as the discovery of gold in one colony after another attracted the fortune-seekers. The distance of Australia from Europe and the cost of passage have been an obstacle to immigration to that country compared with the more accessible Canada and the United States. The attractive force of the gold-mines has partially offset the difficulty, while the colonies have generally adopted a policy of aiding immigrants by paying a portion, if not all, of the passage money. This policy still prevails in Queensland and in Western Australia, and it is only within the last fifteen years that it has been abandoned by the other colonies. Up to 1896 there had been introduced into the colonies, either wholly or partially at the expense of the State, no less than 756,695 persons, of whom 578,559 came in the period prior to 1881.

Under these circumstances, the Australian colonies have to a large extent chosen their immigrants. It is not surprising, therefore, that the great bulk of the immigrants into Australia have been natives of the United Kingdom. According to the census of 1891, 68.58 per cent. of the population were Australian born, 14.76 per cent. born in England and Wales, 3.86 per cent. in Scotland, 7.13 per cent. in Ireland. In other words, 25.75 per cent. of the total population were natives of the United Kingdom, leaving only 5.72 per cent. aborigines, natives of other British colonies outside of New Zealand, and foreigners. Among the last Germans and Scandinavians predominate.

South America. Of the South American countries, the Argentine Republic, Brazil, and Uruguay are the only ones in which immigration brings any considerable increment to the population. In Uruguay the immigration varies between eight and ten thousand persons annually. In Brazil, 860,991 are reported for the years 1871-92. In the Argentine Republic the immigration in the years 1851-99 is reported as 2,564,391. For several recent years the available data are given in the following table:

	Argentina		Uruguay		Brazil
	Immig.	Emig.	Immig.	Emig.	Immig.
1892	....	....	....	....	86,513
1893	....	....	....	....	84,143
1894	80,671	41,921	....	....	60,294
1895	80,988	36,820	....	....	164,371
1896	135,205	45,921	10,505	5,916	157,948
1897	105,143	57,457	9,140	6,779	112,495
1898	95,190	55,536	9,467	6,411	53,822
1899	111,063	62,241	9,006	5,830	....
1900	....	....	8,892	6,705	....

In the immigration to the South American countries, the States of Southern Europe are the largest contributors. Italy stands at the head of the list. In a foreign population of 866,983 in the Argentine Republic in 1895, the Italians numbered 492,636, the Spanish 198,685. The same races predominate in the immigration to Uruguay, while in that of Brazil the Portuguese take the second place, following the Italians, who constitute about one-half of the aggregate immigration.

Canada. There is greater difficulty in determining the amount of immigration to Canada than to other countries, not only because a large number of persons land there whose destination is the United States, but because a considerable number whose original intention was to remain in Canada drift into the United States. So great is the difficulty of precisely ascertaining the number that a few years ago the Canadian authorities gave up the attempt. The most recent figures which are obtainable terminate with the year 1890, and these are put forward by the authorities with many cautions as to their accuracy. In five periods the figures are as follows:

ANNUAL AVERAGE IMMIGRATION TO CANADA

1871-1875	34,212
1876-1880	36,304
1881-1885	115,413
1886-1890	40,911

A computation by British authorities that from 1815-89, 12,481,708 persons emigrated from the United Kingdom, showed that of these 8,317,019 went to the United States, 1,987,247 to Canada, and 1,663,388 to Australasia.

The immigration into Canada is largely from the mother country. The census of 1891 showed that there were 647,362 foreign born in the population, of whom, after deducting natives of the United States, 566,444 had come from across the sea. Of these England and Wales furnished 219,685, Scotland 107,584, and Ireland 149,184, while the quota of foreign nations, among whom Germans predominated, was only 89,991.

United States. The great bulk of those who have left Europe to seek new homes have come to the United States. Here the various phenomena connected with immigration can be studied in their fullest development. Records of immigration to the United States begin in 1820. For the period before that time the chief sources of information as to immigration are the frequent newspaper allusions to the arrival of vessels bringing immigrants, of whom a certain number were 'foreigners,' i.e. those who spoke a language other than English. The record of arrivals since 1820 is shown in accompanying table.

In long periods the increase is marked, but year by year the fluctuation is considerable. It mirrors the economic conditions at home and abroad. Thus the panic of 1837 is reflected in the decline of immigration from 79,340 in that year to 38,914 in 1838. The wholesale emigration from Ireland after the potato famine is reflected in the rise of our immigration from 154,416 in 1846 to 234,968 in 1847, and before this influence and that of the political disturbances in Europe was spent came the discovery of gold and the rush to the mines, which culminated in an immigration of 427,833 in 1854, a figure not reached again until nearly twenty years later. After that year immigration fell off slightly, and received a sudden check after the panic of 1857, when it was reduced from 246,945 in 1857 to 119,501 in 1858. The year 1860 showed symptoms of a rising tide, but this was checked by the outbreak of the Civil War. The prosperous times which followed the close of the war increased immigration until, in 1873, it reached a figure of 459,803, higher than in 1854. Again economic distress brought a falling off, and in 1878 it was not more than 138,469. But the symptoms of returning prosperity in the early eighties reacted powerfully upon the volume of immigration, which in 1882 reached the enormous total of 788.992. By 1886 immigration had fallen to 334,203, but it soon recovered and maintained high figures until 1893. In the following year it dropped to 285,631, and reached its lowest point in recent years in 1898, when it was 229,299, but again there has been a rapid recovery, and in 1902 the total of 648,743 is exceeded by only two previous years, 1881 and 1882.

Influenced by temporary causes, as we have seen, the progress of immigration has been generally forward, with setbacks, apparently temporary, only in the decades 1860-70 and 1890-1900. In estimating the force of immigration it is well to take into account the concurrent growth of the population. The following table brings out the facts:

DECADE	Population at beginning	Immigrants	Immigrants in 10 years per 1000 of initial population
1821-1830.......	9,633,822	143,439	15
1831-1840.......	12,866,020	599.125	47
1841-1850.......	17,069,453	1,713,251	100
1851-1860.......	23,101,876	2.598,214	110
1861-1870.......	31,443,321	2,314,824	73
1871-1880.......	38,558,371	2,812,191	73
1881-1890.......	50,155,783	5,246,616	104
1891-1900.......	62,622,250	3,844,420	61

It appears in this table that the greatest relative immigration has been in the ten years ending 1860, closely followed by the decade 1881-90, and it is to be noted that in each of these periods the agitation against the policy of unrestricted immigration was widespread.

NUMBER OF IMMIGRANTS ARRIVING IN THE UNITED STATES EACH YEAR FROM 1820 TO 1902

PERIOD	Immigrants
Year ending September 30—	
1820	8,385
1821	9,127
1822	6,911
1823	6,354
1824	7.912
1825	10,199
1826	10,837
1827	18.875
1828	27,382
1829	22,520
1830	23,322
1831	22,633
October 1, 1831, to December 31, 1832	60,482
Year ending December 31—	
1833	58,640
1834	65,365
1835	45,374
1836	76,242
1837	79,340
1838	38,914
1839	68.069
1840	84,066
1841	80,289
1842	104,565
January 1 to September 30, 1843	52,496
Year ending September 30—	
1844	78,615
1845	114,371
1846	154,416
1847	234,968
1848	226,527
1849	297,024
1850	310,004
October 1 to December 31, 1850	59,976
Year ending December 31—	
1851	379,466
1852	371,603
1853	368.645
1854	427,833
1855	200,877
1856	195,857
January 1 to June 30, 1857	112,123
Year ending June 30—	
1858	191,942
1859	129,571
1860	133,143
1861	142,877
1862	72,183
1863	132.925
1864	191,114
1865	180,339
1866	332,577
1867	303,104
1868	282,189
1869	352,783
1870	387,260
1871	321,350
1872	404,806
1873	459,803
1874	313,339
1875	227,498
1876	169,986
1877	141,857
1878	138,469
1879	177,826
1880	457,257
1881	669,431
1882	788,992
1883	603,322
1884	518,592
1885	395,346
1886	334,203
1887	490,109
1888	546,889
1889	444,427
1890	455,302
1891	560,319
1892	479,663
1893	439,730
1894	285,631
1895	258,536
1896	343,267
1897	230,832
1898	229,299
1899	311,715
1900	448,572
1901	487,918
1902	648,743

The effect of this immigration on the population can be traced since 1850 in the number of foreign born enumerated by the census, and is shown in the following table:

YEAR	Population	Foreign born	Per cent. foreign born	Increase of foreign born over previous census	Immigration previous decade
1850	23,191,876	2,244,602	9.7		
1860	31,443,321	4,138,697	13.2	1,894,095	2,598,214
1870	38,558,371	5,567,229	14.4	1,428,532	2,314,824
1880	50,155,783	6,679,943	13.3	1,112,714	2,812,191
1890	63,069,756	9,308,104	14.8	2,628,161	5,246,613
1900	76,303,387	10,460,085	13.7	1,151,981	3,687,564

While the total number of the foreign born has increased at each census, the proportion to the total population has not materially changed since 1860. The increase in the foreign born for each decade falls far short of the total number of immigrants by reason of the following factors: (1) Deaths among the foreign born present at the beginning of the decade, and (2) emigration from among the same; (3) deaths among the immigrants during the decade, and (4) return of some of these latter to their native lands. The census of 1900 permits us to estimate some of these factors. There were present in the United States in 1900, 2,609,173 persons who had arrived since 1890, or 7.8 per cent. of the immigration in the period. These had not only made up the loss by emigration in the foreign born population enumerated in 1890, but had, as shown in the table, increased the total number. There remained 1,078,391 persons who arrived in the period 1891-1900 not accounted for by the census of 1900. A certain proportion had died. Were the annual contingent 368,756, or one-tenth of the total, and the death-rate 15 per thousand, the deaths for each contingent would be 5531 annually. Disregarding the year of arrival, the first contingent was here nine years, and the ninth one year, or forty-five years for the first nine contingents, the tenth being disregarded. At this rate the deaths for the period would be 248,895, leaving a remainder of 829,496 immigrants not accounted for, who seemingly contributed nothing to our population. This remainder consists of two classes of persons: first, those who left the United States only to return again; and, second, those who arrived after the enumeration of 1890 and left before that of 1900. We have some data to estimate the relative magnitude of these elements, as we know from figures for the port of New York in 1896, and in the years 1897-1900 for the entire country, that 235,908 arriving immigrants had been in the country before. As this is 15.9 per cent. of the total arrivals, we may estimate that for the entire decade, 1891-1900, 586,223 persons arrived in the United States who had been here before, and so far as any addition to our population is concerned, represented simply a double counting. Some of these arrivals were doubtless enumerated in 1890, and do not therefore figure in the foreign born enumerated in 1900 who had arrived in the previous decade. Others had arrived twice between 1891 and 1900, but were, of course, enumerated only once, at the census of 1900.

There remain of the immigrants of 1891-1900, 243,273 to be accounted for, and these would seem to represent the immigrants who, after a brief sojourn in the United States, returned to their own lands to stay. Fuller information on the whole subject could be obtained had we at our disposal figures for the passengers departing from our shores as well as those who arrive.

Enough has been said to show that immigration does not make the additions to our population which a cursory examination of the figures indicates. It is probable that the duplications, with the greater ease and cheapness of ocean travel, are more numerous of late years than formerly. These duplications do not rob the problem of its seriousness, but give it simply another aspect.

There has been of late years a change in the character of immigration which has been the cause of much concern, and much has been written of the 'undesirable' quality of recent immigration. The most desirable immigrant is doubtless he who promises most rapidly to be absorbed into the great mass of our population and lose his identity as a newcomer. Kinship in language and race is the prime mark of this desirability. Other things being equal, English-speaking immigrants are preferable to all others, those of allied race and language more to be desired than those allied by neither race nor language to the mass of the people.

The developments of recent years are shown in the following figures:

INHABITANTS	Per cent. of total immigration						
	1821–30	1851–60	1871–80	1881–90	1891–1900	1901	1902
United Kingdom	76.5	54.5	43.5	29.9	19.4	9.2	7.1
Germany	6.8	38.2	34.3	30.7	14.1	4.4	4.4
Sweden, Denmark, and Norway	0.2	1.0	11.2	16.0	9.9	8.0	8.3
Italy, Russia, Poland, and Austria-Hungary	0.3	0.4	8.1	19.4	49.3	68.6	70.5
All others	16.0	5.9	2.9	4.0	7.3	9.8	9.7

The last decade shows marked contrasts with the first. Then more than three-quarters of our immigrants spoke English, but now this element represents less than one-fifth of the total. This relative decline was at first made up by an influx of Germans and Scandinavians, peoples of a certain racial kinship, who as late as the decade 1881-90 comprised nearly one-half of the immigrants, while in the latter periods the nations of Southern and Eastern Europe have assumed the leadership. Equally instructive is the separation of the immigrants by race, which for the fiscal years 1901 and 1902 was as follows:

	Per cent. of total immigration	
	1901	1902
Italian	28	28
Polish	9	11
Hebrew	12	9
Scandinavian	8	8
German	7	8
Slovak	6	6
Croatian and Slovenian	3	5
Irish	6	4
Magyar	3	4
English	3	2
Japanese	15	2
Finnish		2
All others		11

That such a notable change in the character of immigration must affect the composition of the foreign born in the United States is obvious, and is disclosed in the following statement from the census of 1900:

FOREIGN-BORN POPULATION, 1900 AND 1890, BY NATIONALITIES

NATIVES OF	Foreign born 1900		Foreign born 1890		*Increase 1890 to 1900	Immigration 1891 to 1900
	Number	Per cent.	Number	Per cent.		
England, Scotland, and Wales	1,169,737	11.3	1,251,402	13.5	*81,665*	270,019
Ireland	1,618,567	15.6	1,871,509	20.2	*252,942*	390,179
Germany	2,666,990	25.8	2,784,894	30.1	*117,904*	505,152
Sweden, Norway and Denmark	1,064,309	10.3	933,249	10.1	131,060	371,512
	6,519,603	63.0	6,841,054	73.9	*321,451*	1,536,862
Austria-Hungary	579,042	5.6	303,812	3.3	275,230	592,707
Italy	484,207	4.7	182,580	2.0	301,627	651,899
Russia and Poland	807,606	7.8	330,084	3.6	477,522	602,010
	1,870,855	18.1	816,476	8.9	1,054,379	1,846,616
All other Countries	1,966,176	18.9	1,592,017	17.2	374,169	304,086
Total	†10,356,684	100.0	9,249,547	100.0	1,107,097	3,687,564

*Figures in italics show decrease.

†The total here given differs from that of a previous table, as this does not include Alaska and Hawaii.

These figures show that the older immigration, relatively stronger in the foreign born than in the new arrivals, is still losing ground. The arrivals in the past decade are insufficient, except among the Scandinavians, to maintain the absolute numbers of ten years ago. On the other hand, the absolute numbers of the foreign born from Eastern and Southern Europe have more than doubled. The apparently anomalous fact that the group 'Other Countries' has increased more rapidly than the aggregate immigration is explained by the entire absence in the immigration returns of any Canadians, who constitute more than one-half of the undistributed foreign born in the above table.

The reports of the Bureau of Immigration enable us to study many characteristics of the immigrants. That males predominate over females, inasmuch as the immigration embraces so many unmarried men, and so many married men who have left their families behind them, who come to seek fortune in the New World, is well known. It is, however, interesting to note that the proportion of males is increasing. In 1893 to 1895 it was 61.5 per cent. of the total; in 1896 to 1900, 63.5 per cent.; and in the last two fiscal years, 1901 and 1902, it averaged as much as 70.1 per cent. The older immigration was by families to a larger extent than at present, and this is seen by comparing some of the older and newer elements in our immigration.

In 1902 the figures for some of the prominent races were as follows:

	Males	Females	Per cent. males
English, Scotch, and Welsh	10,932	7,202	60.4
Irish	12,727	16,274	43.9
German	32,737	24,951	56.7
Scandinavian	36,431	19,349	65.3
Italian	146,961	33,574	81.4
Polish	50,368	19,252	72.3
Croatian and Slovenian	27,097	3,136	89.6
Slovak	29,197	9,737	79.1
Hebrew	32,737	24,951	56.7

It will be noted that in the case of the Irish the women even outnumbered the men, that the races named which show a less percentage of men than the average already quoted, 70.1, belong, with the exception of the Hebrews, to the older immigration. The Hebrews represent more largely than the other races immigration by families.

Among the immigrants the proportion of persons in the prime of life is always considerable. The increase of the proportion indicates a falling off of family immigration. Figures for the entire period are not uniform, but the following statement shows this characteristic plainly:

PER CENT. OF TOTAL IMMIGRATION

FISCAL YEARS	Under 15 years	15–40 years
1893–95	18.8	71.1
1896–98	16.1	72.7

FISCAL YEARS	Under 14 years	14–45 years
1899–1900	13.0	81.4
1901–1902	12.0	82.3

Considering the same races as in the case of the sexes, we find the percentage of children under fourteen in 1902 to be as follows, the average being 11.4:

English, Scotch, and Welsh	16.0
Irish	4.1
German	16.6
Scandinavian	7.8
Italian	10.6
Polish	8.6
Croatian and Slovenian	3.3
Slovak	8.1
Hebrew	26.5

Here again it appears that family immigration is especially prominent among the Hebrews, and plays a considerable rôle among Germans and natives of Great Britain. The low percentage of children among the Irish is a consequence of the large immigration of unmarried women, and this is true, in some measure, of the Scandinavians. Among the newer races, children are very infrequent in the Croatian and Slovenian immigration.

Statistics of occupation among the immigrants show comparatively few in the professional class or that of skilled laborers. By far the greatest number are in the classes grouped as miscellaneous, in which laborers, farm laborers, and personal and domestic servants make up nearly the entire number (393,154 out of 412,879 in 1902). The general results are given in the following table:

OCCUPATIONS	Fiscal years 1881–90		Fiscal year 1902	
	Number	Per cent.	Number	Per cent.
Professional	27,006	1.0	2,937	0.6
Skilled Labor	540,411	19.6	79,768	16.1
Miscellaneous	2,195,292	79.4	412,879	83.3
Total with occupation	2,762,709	100.0	495,584	100.0
No occupation	2,483,904		153,159	
Total	5,246,613		648,743	

The figures above given afford a comparison of the decade ending June 30, 1890, with the last fiscal year, and show that there has been a falling off of the proportion of skilled labor and a growth in that of unskilled labor. That this change is largely due to the newer elements can be seen from an examination of the figures for 1902. For certain races we find the following percentages:

	English	German	Italian	Croatian and Slovenian
Professional	6.2	0.9	0.3	
Skilled Labor	45.9	28.0	13.7	5.4
Miscellaneous	47.9	71.1	86.0	94.6

Corresponding to the figures for occupations are those for illiteracy. The following instructive table is taken from the Report of the Industrial Commission (xv. p. 284):

ILLITERACY AMONG IMMIGRANTS 14 YEARS OF AGE AND OVER

Western Europe	1899	1900	Eastern and Southern Europe	1899	1900
Scandinavian	0.6	0.8	Magyar	10.0	16.9
English	1.7	2.0	Greek	23.8	17.5
Scotch	1.5	2.1	Hebrew	23.0	22.8
Finnish	1.2	2.7	Slovak	27.7	28.0
Bohemian and Moravian	3.4	3.0	Russian	13.5	28.8
Irish	4.0	3.2	Polish	31.3	31.6
French	3.5	4.1	Lithuanian	32.5	32.1
German	3.2	5.8	Croatian and Slovenian	24.9	37.4
Dutch and Flemish	9.3	9.9	Ruthenian	42.6	49.3
Northern Italian	11.4	11.8	Southern Italian	57.3	54.5
			Portuguese	65.6	60.2
Average	2.8	4.0	Average	38.4	36.6

The races here enumerated range themselves according to the general degree of education at home, though it should be noted that the proportion of illiterates is generally higher among immigrants than in the population at large of the countries whence they come.

SECTIONS	Native born	Foreign born	Per cent. native born	Per cent. foreign born
United States	65,843,302	10,460,085	86.3	13.7
North Atlantic States	16,283,899	4,762,796	77.4	22.6
South Atlantic States	10,227,450	216,030	97.9	2.1
Northern Central States	22,174,530	4,158,474	84.2	15.8
Southern Central States	13,722,392	357,655	97.5	2.5
Western States	3,245,028	846,321	79.3	20.7

EFFECT UPON THE POPULATION. The influence of immigration upon the population at large depends not only upon its volume, but also upon its diffusion. We have already seen that the foreign born in 1900 constituted 13.7 per cent. of the total population of the country; but it is to be noted that of the ten million foreign born enumerated, few more than half a million were found in the Southern States both of the Atlantic coast and the Mississippi Valley.

The figures for 1900 are in the table above.

It will be noted that the largest number of foreign born is in the North Atlantic division, and here, too, the proportion is the largest. In 1890 the largest proportion was in the Western division, the largest number in the North Central division. Of the aggregate increase of 1,151-891 in the number of the foreign born, 874,619 are credited to the North Atlantic States. Here the proportion of foreign born slightly exceeds 30 per cent. in Rhode Island and Massachusetts, and is greater than 25 per cent. in New York and Connecticut. In the Northwest these figures are paralleled by 35.4 per cent. in North Dakota, 28.9 in Minnesota, and 24.9 in Wisconsin. While not drawn from urban classes at home, the foreigners tend to concentrate in cities. In the principal cities of the nation (161 cities, having over 25,000 inhabitants), as much as 26.1 per cent. of the population is foreign born, while in the remainder of the country but 9.4 per cent. are foreign born.

This tendency to the cities is due not only to the fact that cities represent the most rapidly developing part of our population, and hence exercise the strongest attraction for the floating elements, but in part also to the fact that the immigrant finds in the cities groups of his own countrymen, upon whom he naturally relies to establish relations with the world into which he has come. Hence it occurs that in one place certain nationalities will predominate which are insignificant in numbers in other cities. The census report of 1900 gives in detail nationalities of nineteen cities having 200,000 inhabitants, and of ten other cities where the foreign born number at least 30,000. In seventeen cities the Germans lead, their proportions varying from 28.8 per cent. of all foreign born in New York, to 65.9 per cent. in Cincinnati; in nine cities the Irish lead, with proportions between 17.3 in Paterson, N. J., and 36.9 in Cambridge, Mass.; in two cities, Fall River and Lowell, the French Canadians are most numerous, with proportions of 40.3 and 35.8 per cent. respectively; while Swedes, with 32.8 per cent., lead the foreign born in Minneapolis.

The cities having, on the one hand, the largest number of foreign born, and, on the other, the largest percentage of foreign born, were:

FOREIGN BORN IN CITIES, 1900

CITIES	Population	Foreign born	Per cent.	CITIES	Population	Foreign born	Per cent.
New York	3,437,202	1,270,080	37.0	Milwaukee	285,315	88,991	31.2
Chicago	1,698,575	587,112	34.6	Fall River	104,863	50,042	47.7
Philadelphia	1,293,697	295,340	22.8	Passaic	27,777	12,900	46.7
Boston	560,892	197,129	35.1	Lawrence	62,559	28,577	45.4
Cleveland	381,786	124,631	32.6	Woonsocket	28,204	12,518	44.4
San Francisco	342,782	116,885	34.1	Lowell	94,969	40,974	43.1
St. Louis	575,238	111,356	19.4	Manchester	56,987	24,257	42.6
Buffalo	352,387	104,252	29.6	Holyoke	45,712	18,921	41.4
Detroit	285,704	96,503	33.8	New Bedford	62,442	25,529	40.9

The natives of regions showing at least 25,000 persons in the three principal cities are shown in the following statement:

STATEMENT OF GROUPS EXCEEDING 25,000 OF FOREIGN RACES IN PRINCIPAL CITIES

NATIVES OF	New York	Chicago	Philadelphia
Bohemia	....	36,362	
Canada (English)	....	29,472	
England	68,836	29,308	36,752
Germany	322,343	170,738	71,319
Hungary	31,516		
Ireland	275,102	73,912	98,427
Italy	145,433		
Poland	32,893	59,723	
Russia	155,201	......	28,951
Sweden	28,320	48,836	
Total foreign born	1,270,080	587,112	295,340

In the census report the Poles are distributed to Austria, Germany, and Russia. Those from Russia are most numerous in New York; those from Germany in Chicago.

Buffalo, Cincinnati, Cleveland, Detroit, Milwaukee, New York, Saint Louis, and San Francisco have German populations exceeding 25,000, while Boston has like groups of Irish and English Canadian, and Detroit such a group of her Canadian neighbors.

But these figures do not display the whole significance of the city concentration, for it will be remembered that immigrants are largely men and adults. The proportion of foreigners among males of voting age is perhaps a more forcible indication of their influence in the community. A few figures for the cities where the foreigners are numerous may be noted:

MALES OF VOTING AGE, 1900

CITIES	Total	Native born	Foreign born
New York	1,007,670	460,445	547,225
Chicago	511,048	237,688	273,360
Philadelphia	386,953	257,575	129,378
Boston	176,068	93,488	82,580
Cleveland	111,522	54,378	57,144
San Francisco	128,985	62,251	66,734
Saint Louis	171,798	116,218	55,580
Buffalo	97,938	52,917	45,021
Detroit	78,855	38,496	40,359
Milwaukee	75,020	34,535	40,485

In the ten cities there are four only, Philadelphia, Boston, Saint Louis, and Buffalo, in which the number of foreign born potential voters does not exceed the number of the native born. This does not imply that the foreign born have anywhere a political majority, as there is among them a considerable proportion of unnaturalized persons, the average for the nation showing about one-fourth of the foreign born to be aliens.

The significance of this concentration is in its relation to the problem of assimilation. The evidences of assimilation cannot well be treated statistically, and we have only a few indications of it. One of these lies in naturalization. In 1900, 56.1 per cent. of the foreign born adult males had been naturalized, and 8.2 per cent. had taken out their first papers. The extent of naturalization depends upon the length of time which the foreigners have been in the country. Thus, of the 1,001,595 aliens enumerated in 1900, 599,917 had been in the United States less than ten years, while the much larger contingent of foreign born of longer residence showed only 441,678 aliens.

Another statistical evidence of assimilation is found in the acquisition of the English language. There were enumerated in 1900 1,217,280 foreign born persons over ten years of age, or 12.0 per cent. of the total, who could not speak English. But many of the foreign born from Great Britain and Ireland and Canada speak English as their mother tongue, as much as 24.5 per cent. of all. Allowing for these, the percentage of foreign born who had no English antecedents and who had not acquired English was 18.3. The census reports do not go sufficiently into details to give us any indication how far the inability to speak English was due to unwillingness to acquire it and how far to lack of opportunity, due to recent arrival in the United States. It has already been noted that 2,609,173 of the foreign born had arrived in the preceding decade, and that in the decade the non-English speaking elements, even allowing for immigration from Canada, approximated three-fourths of the arrivals. That the foreign element is not averse to learning English would seem to be indicated by the fact that among the native whites of foreign parentage the proportion who do not speak English is only 0.6 per cent.

If we turn now to consider the social effects of immigration we find our testimony chiefly in the statistics of illiteracy, crime, pauperism, and insanity. The effect of immigration can be seen in comparing the figures showing the proportion of illiterates in the population ten years of age and over in the United States, and in those sections where the foreign born are most strongly represented.

PERCENTAGE OF ILLITERACY

	United States	North Atlantic States	Northern Central States	Western
Native white, native parents ...	5.7	1.7	2.7	3.4
Native white, foreign parents...	1.6	1.5	1.3	1.3
Foreign white....	12.9	15.9	9.4	8.5
Colored	44.5	14.6	24.6	42.8
Total	10.7	5.9	4.2	6.3

In the United States at large the illiteracy among the foreign white is far greater than among the native white, and this discrepancy is still greater in the Northern and Western States. It is, however, interesting to note that in the second generation, the native white of foreign parents, the discrepancy disappears. On the face of the figures there is even a superiority over the natives of native parents; but this is probably due to the better school facilities in the cities and towns, where so large a proportion of the foreign element dwell.

CRIME. It is often claimed that the immigrants fill the jails and penitentiaries of the country; and the impression is widespread that, were it not for immigration, there would be little use for such institutions. This impression is entirely erroneous. While it is likely that the foreign born contribute somewhat more than their proportional quota to the army of law-breakers, the disproportion is by no means such as to change materially the amount of crime which would occur were there no foreigners in the population. The extent of their influence upon the volume of crime may be briefly studied.

No data are available for 1900, but in the census of 1890 we read that the ratio of prisoners to one million of the population is 898 for the native white and 1768 for the foreign white. As the foreign white are little more than one-eighth of the entire community, it is clear that these proportions would not attribute to them an absolute majority of the crimes committed. Nor is the relative proportion of crime among the foreign born as great as these figures would indicate. They relate to the entire population, while the adult population only contributes to the population of prisons. A comparison of the two elements by age classes, as shown by the following table, is more accurate:

MALE PRISONERS, 1890

AGES	Numbers		Ratio to 1,000,000 population	
	Native white	Foreign white	Native white	Foreign white
10-19	4,227	599	780	1,308
20-29	17,713	4,492	4,353	4,164
30-39	9,737	3,695	3,257	3,536
40-49	4,068	2,744	2,189	3,020
50-59	1,623	1,547	1,327	2,336
60-79	676	722	614	1,263
80 and over........	15	22	161	638

The larger proportion of foreign born in the ages ten to nineteen is due to the fact that the foreign born increase in number as they approach twenty years of age, while among the native born the numbers decrease from ten years onward. In the characteristic ages of twenty to forty there is no substantial difference between the foreign white and the native white. In the later age classes the comparison is slightly unfavorable to the foreign white.

These figures relating to the population of prisons are not altogether satisfactory. They lay undue emphasis on the more serious crimes and minimize the lesser offenses, and thus fail to give an accurate picture of the amount of crime committed in a given year. The fact that the foreign born are more numerous among the prisoners with short sentences shows us that if the enormous volume of petty crime which is committed annually were adequately recorded the proportion of the foreigners would considerably increase. There is, moreover, evidence which cannot be recited here in detail that the native whites of foreign parents are less law-abiding than the foreign whites and contrast very unfavorably with the native whites of native parentage.

There are few subjects upon which the official records are more thoroughly unsatisfactory than in regard to crime, and all statements must be made in broad, general terms. It should, however, be remembered that a greater proportion of law-breaking among the foreign element might be adequately accounted for if we were able to divide the population into the social classes as respects wealth, education, and mode of living which actually exist in it. It is not improbable that in such a division it would appear that the foreign element showed no greater proportion of crime than the social strata to which they belong.

PAUPERISM. It is natural that the foreign born should contribute in larger measure than do the native to the population of the almshouses. They come here without property and are found generally among the poorer classes. Moreover, when age or incapacity overtakes them they have not the same relatives or friends to care for them as is frequently the case among the native population. It need not surprise us that the census of 1890, no figures for 1900 being available, showed that in every million of the population there were 829 native white paupers and 3131 foreign white paupers, or nearly four times as many. While this is due in part to the condition above described, the figures are again misleading, since the active ages in the population contribute little to the population of almshouses. This is brought out in the following table, showing the paupers by age classes, in which it is to be noted that nowhere is the disproportion nearly so great as in the figures for the aggregate population:

PAUPERS IN ALMSHOUSES, 1890

AGES	Numbers		Ratio to 1,000,000 population	
	Native born	Foreign born	Native born	Foreign born
Under 10..........	3,651	55	287	164
10-19..........	2,228	172	207	187
20-29..........	3,979	1,352	491	680
30-39..........	5,400	2.403	934	1,326
40-49..........	4,931	3,832	1,341	2,396
50-59..........	4,383	4,810	1,835	3,979
60-69..........	4,548	6,956	3,110	8,814
70-79..........	4,542	5,553	6,451	18,498
80 and over.....	2,543	2,199	12,515	31,196

INSANE. A greater tendency toward insanity has been noted among the foreign element of the population than among the native. No adequate explanation has been given for this phenomenon. The figures usually quoted, to the effect that in 1890 there were 1405 native white insane and 3870 foreign white insane per million of their respective populations, like most of the figures relating to social conditions of the foreign born, exaggerate the situation. An examination of the ages of the insane shows that the greater number of those so afflicted are between the ages of twenty-five and fifty-five. A comparison for these ages of the foreign white and native white shows that the disproportion, while considerable, is by no means as large as in the general population.

Insane, 1890

Ages	Numbers		Ratio to 1,000,000 population	
	Native born	Foreign born	Native born	Foreign born
25–40	17,293	7,569	1,850	2,658
40–55	13,787	10,848	2,725	4,602

Industrial Effects. Looking at the immigration problem from the economic side, we not infrequently hear a complaint that immigration lowers wages. In prosperous times little is heard of this, but when depression sets in complaint becomes general.

The difficulty here is to determine the facts. So complex are the conditions affecting wages that the Industrial Commission, after hearing the most conflicting evidence on both sides of the question, is forced to conclude that a positive effect of immigration on wages cannot be predicated.

The proposition can be supported by inference rather than by direct proof. If the numbers of the foreign born in a given industry are small, it is contrary to reason to suppose that they have a depressing effect upon wages. This raises the question of the amount of competition in a given industry. To this the answer can be found in the census statistics of occupations. The analysis of occupations by nativity has been reserved by the census authorities for a special volume, and we must therefore have recourse to the figures for 1890. The following table shows the percentage in each of the main branches of industry of the foreign born and of the native born in comparison with the population of ten years and over:

Occupations of Males, 1890. Percentage of Foreign Born

	Foreign born
Agriculture, fisheries, and mining	15.54
Professional service	15.13
Domestic and personal service	36.21
Trade and transportation	22.25
Manufacturing and mechanical industries	34.04
All occupations	23.58
Population 15 years old and upward	22.05
Special Occupations	
Gardeners, florists, nurserymen, and vine-growers	44.50
Restaurant and saloon-keepers	49.66
Hucksters and peddlers	53.13
Bakers	59.52
Boot and shoe makers and repairers	40.07
Cabinet-makers and upholsterers	46.17
Cotton, woolen, and other textile mill operators	46.05
Leather curriers, dressers, finishers, and tanners	47.62
Marble and stone cutters	46.28
Tailors	71.12

The concentration of the foreigners in industrial pursuits, as indicated by this table, is to be correlated with their tendency to gravitate toward the cities already discussed. They have gone to the cities because the latter furnish the opportunities of employment, and this was due to the development of mechanical and manufacturing industries. The proportion of the foreign born in these broad groups is not such as to lead us to infer that they exercise a dominating influence upon wages, even if it could be proved, which is extremely doubtful, that they are any more willing than the native laborer to work for low wages. It can therefore only be in certain specified industries, in which the proportion of the foreign born is very large and in which the pressure for work is considerable, that any appreciable influence upon wages will be exerted. Where they do not thus dominate an industry they conform to the current rate of wages. Investigations of the Commissioner of Labor into the cost of production in the iron and steel industries and in the textile industries amply prove this proposition.

On the other hand, where the foreign born crowd for employment and dominate a given industry, as in the clothing industry in New York and Philadelphia, they reduce the rate of wages, and such a permanent reduction is possible because the standard of living which they adopt is so much inferior to that which is customary among their American competitors. The contest with the sweatshop in our great cities leaves no doubt upon this point. The report of the Industrial Commission furnishes cumulative evidence of this tendency in a few lines of activity to build up industries on a basis of starvation wages which themselves rest upon the ignorance, helplessness, and incapacity of the foreign-born population of the tenement-house districts.

The testimony which has been brought forward with respect to the political, social, and industrial effects of immigration is of necessity indefinite in character. The problem of immigration is a problem of assimilation; and this means conformity to modes of living, modes of thought, and modes of action in many different fields of activity. There may be incapacity, but undoubtedly there is no unwillingness on the part of those who permanently reside among us to share to the fullest extent possible in the life of the community, with its opportunities and privileges. With respect to the permanent additions to the population, the question which concerns us is as to how far it is desirable that we should continue to recruit what are economically the weakest and least promising classes in the community. The idea that there must always be some one to do rough work has no standing in court. Modern engineering devises mechanical appliances for these purposes, and we have no fear that progress will cease because the human race is unwilling to be mere hewers of wood and drawers of water. It remains to consider, therefore, how far legislation has attempted to cope with the problem, and what has been its success in such an effort.

Legislation. It has already been pointed out that immigration into the United States was so much a matter of course that before 1820 it was not even recorded. While in that year records of the number of arrivals were introduced, nothing was done in the way of legislation, either to promote or to restrict immigration into the United States, until the year 1864.

We may disregard the brief period in which the famous Alien Law was in force, 1798 to 1801, which authorized the President to expel foreigners dangerous to the peace of the nation, for this law was passed to meet a supposed political danger, and not to avert a threatened economic injury. Nor did the agitation against the foreigner, which gained such force in the Know-nothing movement during the early part of the fifties, lead to legislation. It is doubtful if the question would have assumed so large an importance had it not been for popular discontent with the older political parties. Moreover, the agitation was quite as much anti-Catholic as it was anti-foreign, and no majority of the American people could be gained for an attitude savoring of religious persecution.

The police and sanitary regulations, including quarantine, affecting the immigrants upon their landing in the United States, were matters of State, and not Federal legislation.

When, in 1864, Congress finally took cognizance of the immigration question, it was with the idea of encouraging immigration into this country. Under the pressure of the demand for laborers in industrial pursuits, an act was passed to encourage immigration which offered to the immigrants freedom from compulsory military service, and the services, upon their arrival, of a Commissioner of Immigration, whose duty it was to assist immigrants in obtaining transportation to their destination, and to protect them from the impositions to which their ignorance exposed them. The act was repealed in 1868, and no further legislation to promote immigration was enacted. The general spirit of the times was, however, favorable to immigration, and certain special reports of the Bureau of Statistics, *Labor in Europe and America* (1870), for instance, were widely disseminated with a view to encouraging immigration. About the same time the States, particularly those of the West, established boards and commissioners of immigration, charged with the duty of promoting immigration into their respective States.

It soon became evident that encouragement was no longer needed, and the tide of public opinion began to turn toward restriction. This did not at first extend beyond the idea of preventing the introduction into the country of manifestly undesirable elements—the criminal, the pauper, the insane, and the vicious. Section 1 of the act of August 3, 1882, imposed a head tax of 50 cents (increased to $1 by the act approved August 18, 1894, and to $2 by act of March 3, 1903) on each passenger not a citizen of the United States, stipulating that the money collected shall be paid into the United States Treasury as a fund to defray the expenses of regulating immigration, of caring for immigrants, and relieving those in distress, and for the general purposes and expenses of carrying the act into effect. (This fund, it may be remarked, has been found ample for its purposes, and an annual surplus has been turned into the Treasury.)

Section 2 provided that the Secretary of the Treasury should be charged with the duty of executing the provisions of the act, and for that purpose empowered him to enter into contracts with the officials of the several States at their several ports. By the act of March 3, 1903, the Commissioner-General of Immigration is placed under the authority of the Secretary of the Treasury, although the Immigration Bureau is subordinate to the Department of Commerce.

Section 3 provided that the Secretary of the Treasury establish such rules and regulations, and issue, from time to time, such instructions, not inconsistent with law, as he should deem best calculated for the protection of immigrants from fraud and loss, and for carrying out the provisions of the act and the immigration laws of the United States, etc.

Section 4 treated of the exclusion and deportation of specified classes. It provided that foreign convicts, except those convicted of political offenses, lunatics, idiots, or any persons not able to take care of themselves without becoming public charges, should be sent back at the expense of the owners of the vessels on which they had come.

The act of 1882 is still in force in principle, though in minor points it was modified by a law of March 3, 1891, of which the following section is the most important:

"That the following classes of aliens shall be excluded from admission into the United States, in accordance with the existing acts regulating immigration, other than those concerning Chinese laborers: All idiots, insane persons, paupers, or persons likely to become a public charge, persons suffering from a loathsome or a dangerous contagious disease, persons who have been convicted of a felony or other infamous crime or misdemeanor involving moral turpitude, polygamists, and also any person whose ticket or passage is paid for with the money of another, or who is assisted by others to come, unless it is affirmatively and satisfactorily shown, on special inquiry, that such person does not belong to one of the foregoing excluded classes, or to the class of contract laborers excluded by the act of February 26, 1885; but this section shall not be held to exclude persons living in the United States from sending for a relative or a friend who is not of the excluded classes under such regulations as the Secretary of the Treasury may prescribe. *Provided*, That nothing in this act shall be construed to apply to or exclude persons convicted of a political offense, notwithstanding said political offense may be designated as a 'felony, crime, infamous crime, or misdemeanor involving moral turpitude' by the laws of the land whence he came, or by the court convicting."

The act was further amended by the law of March 3, 1903. By this law the Bureau of Immigration is given a right to deport epileptics, persons who have been insane within the five years preceding their arrival in America, and persons who advocate the overthrow of all governments or the assassination of public officials. Deportation may take place any time within two years after arrival.

The joint administration of immigration affairs by Federal and State officials which had been in vogue since the passage of the act of 1882 had not proved satisfactory, and by the act of 1891 the entire charge of the matter was assumed by the general Government. The statute of March 3, 1893, took a step in advance of previous legislation by requiring at least a preliminary inspection of immigrants at the point of departure. Each immigrant is provided with a number identifying him to the inspectors of the United States. The medical inspection provided by the act has been a useful aid in preventing the introduction of disease.

Side by side with legislation to exclude persons morally and physically undesirable has gone the effort to exclude the contract laborer. The first law on this subject was passed February 26, 1885. It made it unlawful for any person, company, partnership, or corporation in any manner whatsoever to prepay the transportation or in any way assist or encourage the importation or migration of any alien or foreigner into the United States, under contract or agreement or parole, special, expressed or implied, made previous to the importation of such alien or foreigner to perform labor or service of any kind in the United States.

The object of this legislation was to prevent the agents of manufacturers from contracting in Europe with the laborers, oftentimes in herds, for the purpose of breaking strikes or introducing a supposedly more docile, because more ignorant, class of laborers. Moreover, it is plain that contracts made abroad would be made with reference to the scale of wages existing in foreign countries rather than those in force here, and would thus introduce a lower-priced competition, dangerous to the well-being of the working classes. The general spirit of the law has been commended by public opinion, though in its first form it presented some crudities which placed it in a ridiculous light, as where a clergyman was denied admission to the United States by reason of a contract made in England to assume charge of a parish in New York. Subsequent modifications distinctly eliminating the professional classes and bringing the operation of the law within the intention of the legislators have much improved the statute.

The general characteristic of the United States immigration laws is, that whoever enters in violation of the law is to be returned to the point of departure at the expense of the steamship company which brought him, and that this liability extends in all cases for a period of one year after arrival. The machinery for the enforcement of the law has been progressively improved. The number of immigrants who have been returned is as follows:

YEAR	No. returned	Per cent. of total immigration	YEAR	No. returned	Per cent. of total immigration
1890..	535	0.11	1896...	2,799	0.81
1891..	1,026	.19	1897..	1,880	0.81
1892..	3,732	.64	1898...	3,229	1.45
1893..	1,630	.36	1899...	4,061	1.30
1894..	2,806	.98	1900...	4,602	1.02
1895..	2,419	.93			

The main reason for the return of immigrants is pauperism.

One of the great difficulties in the way of the thorough administration of the law is the comparative ease with which persons of the undesirable classes obtain access to the United States through Canada. Arrangements have recently been perfected between the Canadian Government and the immigration service establishing an inspection in Canada. The effort is made to inspect not only the immigrants who give the United States as their destination, though arriving at Canadian ports, but also those who give Canada as their destination, but come into the United States. The fact that of less than 5000 persons of the latter class inspected, 2000 were turned back, indicates clearly that the ineligible classes have been coming into the United States over the Canadian border.

The present immigration laws represent little more than sanitary measures designed to protect our society from the introduction of positively vicious and undesirable elements. The demand has been heard, and has been supported by a wealth of argument, that we should be more liberal in our interpretation of the word 'undesirable,' and exclude also such immigrants as, by reason of incapacity and ignorance, give the least promise of assimilation.

The question of still further restricting immigration made its appearance in the early nineties. It was felt that many persons were admitted into the United States who were not desirable acquisitions to our population. The demand was heard in many quarters that the illiterate should be excluded, and the question was actively agitated in Congress until 1897. In that year a bill passed both Houses of Congress which excluded from admission to the United States all foreign persons over sixteen years of age who could not read or write the English or some other language, except parents or grandparents accompanying persons otherwise qualified, or coming to join relatives already in the United States. The bill was vetoed in the closing hours of Congress, March 3, 1897, by President Cleveland, on grounds of general policy, as well as for material defects in the measure, such as the exclusion of the illiterate wives of qualified persons. The bill was reconsidered in the House of Representatives and passed over the President's veto by the constitutional majority of two-thirds; but as it passed the Senate by a narrow margin, no attempt was made to force a vote in that body, and the veto message was simply referred to the appropriate committee. In the following years the agitation subsided in view of the decreased number of immigrants. See CHINESE IMMIGRATION.

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IMMOLATION (Lat. *immolatio*, from *immolare*, to sacrifice, from *in*, in + *mola*, meal, mill-stone, from *molere*, to grind; connected with Goth., AS., OHG. *malan*, Icel. *mala*, Ger. *mahlen*, to grind, Eng. *meal*). A Roman sacrificial ceremony in which the victim was sprinkled with meal coarsely ground and mixed with salt (called *mola salsa*). Hence to 'immolate' means to 'sacrifice.'

IMMORALITY (from Lat. *in*-, not + *moralis*, moral, from *mos*, custom, right). In its broadest sense, any breach of the moral law; in a narrower sense, as contrasted with illegal conduct, an act of omission which is condemned by the law of morality, but which may not violate any rule of municipal law (q.v.). Many forms of moral conduct come under the condemnation of the criminal law, and it is the tendency of advancing civilization to brand with criminality many classes of acts which were formerly left to the penalties of conscience or of the Church. Other classes of immoral acts, not branded as criminal, yet incur indirectly the condemnation of the law, as by denying to the person who has been guilty of them his right to enforce a claim arising upon a contract or a tort. Thus a bond given for an immoral consideration, or to secure the performance of an immoral act, is unenforceable. Immorality which does not fall under the ban of municipal law rarely if ever affects the legal rights or status of a person. It may subject him to social censure, but it does not defeat him in the prosecution of a legal claim. Compare Malum in Se.

IMMORTALITY (Lat. *immortalitas*, from *immortalis*, undying, from *in-*, not + *mortalis*, mortal, from *mors*, death; connected with Skt. *mar*, to die, Gk. *μόρος*, *moros*, death, and *βροτός*, *brotos*, mortal, Lith. *mirti*, to die, OChurch Slav. *mrŭtvŭ*, dead, OHG. *mord*, Ger. *Mord*, murder, AS. *morþ*, death). The endless existence of the human soul in the continued possession of its distinct personality and consciousness. How early the idea of a survival after death entered the mind of man cannot be determined. There is no evidence of it in the Paleolithic period. But in the Neolithic period not only the ornaments, weapons, tools, and food placed by the side of the dead, but the houses, mounds, chulpas, and tombs built for them, testify to a belief that some of the dead for some time continue some kind of an existence after death. It is probable that at first death was looked upon as a deep and prolonged sleep. The dead was left in his dwelling-place, the survivors seeking a new home, or a special structure was made for him. Visions of the departed in dreams naturally led to the conclusion that they left their dwellings in the night, and, upon further reflection, to the theory of a double or finer material, but dependent upon the food and drink brought to the tomb. The practices of the Neolithic period already imply the development of some such theory of a 'soul.' The fact that these customs and the faith they imply survived into the more advanced civilizations of antiquity and are to be found extensively at the present time among peoples that have remained upon lower stages of development, indicates for them a very high age.

Tombs were the earliest temples, and the ancestral cult was the earliest form of divine worship. As long as offerings were made to the dead the departed ancestors were believed to exist and to protect their descendants. Thus the cult itself tended to create a confidence in an indefinite prolongation of existence in the case of the objects of filial worship. As the great cosmic forces began to attract more attention the double of the dead might be connected with them in one way or another, and thereby become more independent of the tomb. But even where, as in Egypt, this process can be most clearly perceived, the ancestral cult as the basis of hope for survival maintained itself to the latest times. Whether the mass of men in Egypt who were too poor to pay the cost of embalming and 'a house for eternity' were regarded as long surviving the shock of death is doubtful. But the assurance in a future life, as rich as the present and not very different in its outward conditions, for those properly embalmed and entombed, was very strong. Numerous pictorial representations and inscriptions in tombs and papyri from different periods show how intensely the inhabitants of the Nile Valley believed in a life after death.

Starting from the same premises, speculation as to the future took a different turn in India. The doctrine of metempsychosis was developed. Without losing its identity, the spiritual substance in man was supposed to enter into other forms of life, rising or sinking in the scale of being in consequence of the deeds wrought in the body and the character formed. (See Eschatology.) This transmigration of souls implied eternal existence before as well as after any appearance in the world as a human being. It precluded the idea of a disembodied spirit, and it adjusted outward circumstance to inner character, punishment to crime, and reward to virtue more nicely than any other system of thought. But this assurance of eternal life became itself a burden to the mind of man, and it cried out for deliverance from the endlessly turning wheel of existence. Buddhism offered relief in the hope of Nirvana. In Persia, Mazdaism proclaimed, possibly not in the Gathic period, but certainly as early as the third century B.C., the doctrine of a resurrection (q.v.). This doctrine was no doubt based upon the simpler and more widespread belief that the sleepers in the dust might be aroused. Cases of apparent death and successful resuscitation would strengthen this expectation. The animistic basis is quite evident.

Among the Iranian peoples of the northwest, the Sarmatians, the Scythians, and the Thracians, the faith in a future life was very strong. From Thrace the Orphic cult spread in the Greek world. While the Mycenæan tombs, as compared with the remains of the preceding age, reveal a growing importance attached to the life beyond, but no conceptions differing from those generally associated with the ancestral cult, and the Homeric poems tell of Elysian fields as well as a barren and cheerless Hades, but put no emphasis upon what still is a somewhat shadowy existence beyond with no moral distinctions, the Orphic cult societies offered to the initiated the hope of a blessed immortality. (See Eschatology; Heaven; Hell.) The arguments of Socrates and Plato are far from being the first intimations of immortality among the Greeks. They are not endeavors to open new vistas into a life beyond. On the contrary, they represent a critical tendency seeking to establish the truth of a view held by many, and to find the rational grounds on which it can be maintained, if at all. In the following periods skepticism prevailed in some circles, ardent belief in others. If the practical character of the Roman caused him to cling to the ancestral cult, his hospitality to religious ideas opened the doors to the doctrines taught by the Orphic and Dionysiac societies. It was a real life of battle and of joy to which the Teutonic warriors looked forward in Odin's hall, Valhalla.

Among the Semitic nations the prevailing view left little joy in the thought of man's fate after death. The Babylonians and Assyrians seem to have believed in a semi-conscious later existence, but with no distinctions based on character or conduct, and no feature rendering it desirable. The myth of Ishtar's descent to the nether world shows that imagination occupied itself with the abode of the dead, and the translation of some heroes to be with the gods tends to mark the contrast with the ordinary issues of human life. Substantially the same conception of the future was held by the ancient Hebrews. (See SHEOL; HADES.) There was no conception of an endless existence of the human soul in possession of a distinct consciousness, and no intimation of a difference based on conduct in this life. A poetic passage (Isa. xiv.) possibly shows that the kings were thought of as sitting upon thrones—consequently a social distinction. The intense religious life of the nation did not occupy itself much with the future of the individual. Neither the prophets, nor the legislators, nor the poets, nor the great wisdom-teachers, seem to have attached much importance to it. Their opposition to the ancestral cult and to necromancy may account in a measure for this indifference. Only as the sufferings of innocent individuals, particularly in the Exile, made the question of the divine government of the world acute, did 'the hope of man' receive attention by the thinkers of Israel. But the author of Job presents this possibility of a restoration to life only in order to reject it. He is not willing to obscure the issues by the introduction of what he considers a vain and improbable speculation. A high type of piety thus flourished without a hope of immortality. But the growing demand for a justification of the ways of God was met by foreign conceptions that brought relief by a temporary postponement of the problem. Persia contributed the thought of a resurrection, Greece that of immortality in the stricter sense. The conception of a resurrection appears for the first time in Jewish literature in the Book of Daniel (written about B.C. 165). Here some of the dead are raised, probably the martyrs of the great persecution and their oppressors, to continue their life on earth.

There is evidence that this new life was sometimes regarded as of limited duration. In regard to the new body, some maintained that it was identical with the old, or of a similar substance; others that it was spiritual; some that it was bestowed on men at a general resurrection in the future; others that it was given immediately after death. In some circles it was thought that only the Israelites or the good would be raised; in others, that all men, even the wicked, would rise. (See RESURRECTION.) The new doctrine was chiefly accepted by the Pharisees; the Sadducees strongly opposed it. Ecclesiastes rejected the idea of a survival after death in every form. Meanwhile the Greek conception of immortality based on the nature of the soul, with or without the notion of preëxistence, found acceptance not only among the Alexandrian Jews, but to some extent also in Palestine. A doctrine of a future life in which the resurrection had no place is found in the Slavonic Enoch, Wisdom of Solomon, Philo, among the Essenes, and elsewhere. Jesus himself seems to have believed in a spiritual resurrection occurring immediately after death. A somewhat similar conception is found in the Pauline literature, while the Fourth Gospel presents the eternal life as a sharing in the divine nature that may begin in time and continue through eternity, and seems to use the term 'resurrection' figuratively. The firm conviction of the early Church that Jesus had risen from the nether world and ascended to heaven, and that He would presently return in glory to raise the dead and establish His kingdom on earth, tended to base the hope of survival upon His resurrection.

In I. Corinthians xv. the thought is expressed that if Jesus was not risen His disciples are not raised, and that it does not matter how life is lived, if that is the case. It was felt that through His resurrection He had thrown light upon life and immortality. Much of the success of Christianity was no doubt due to the prospect that it held out for a future life. It offered to all men, even slaves and barbarians not permitted to participate in the official cult and not invited to take the holy vows of the secret cult-societies, the same blessed immortality that was promised to those initiated in the Orphic, Dionysiac, and Mithraic mysteries, and it was itself influenced by the thoughts that had prevailed in these religious societies. (See HEAVEN; HELL.) The Greek idea that the soul is immortal by virtue of its own nature became dominant in Christian theology. The controversies within the Church have not affected this fundamental position, but have had reference to the character of the future life.

Through Maimonides the Greek conception of immortality found its way into the synagogue. At first it had a tendency to exclude the doctrine of a resurrection; subsequently it was made the philosophical basis of this doctrine as in the Church. With the renascence of learning and the development of natural science doubts as to the immortality of the soul began to be expressed. Uriel Acosta (q.v.) was persecuted for rejecting this doctrine, and he had sympathizers among the deists. The growth of evolutionary philosophy in the nineteenth century led many minds to question the survival of the human soul after death, and the possibility of a continued life of the spirit apart from the bodily organism is to-day widely denied in scientific circles. Various reasons are given for this negative position. It is maintained that the mental life of man is so closely connected with and invariably dependent upon the brain that a continuance of any intellectual functions after the dissolution of the body is inconceivable. As the mentality of man appears to differ from that of the animal only in degree, and not in kind, any argument from the peculiarities of the human mind is held to imply also the immortality of the lower organisms.

Still greater difficulties are thought to arise from man's embryological development. The lack of any convincing evidence of communication between the dead and the living is pointed out, and it is urged that the origin of the belief can be naturally accounted for, and that its persistence is largely due to the social conditions in which man is placed. On the other hand, the doctrine is defended not only from the standpoint of belief in an infallible revelation, but also by thinkers who claim the right of free inquiry, and base their views solely upon what appears to them to be sufficient evidence. As a more careful exegesis renders it increasingly difficult to appeal to the Old Testament on that subject, it is generally the New Testament, and particularly the words ascribed to Jesus himself, that furnish the authority. Even from an independent point of view, great weight is often accorded to the conception of Jesus and the New

Testament writers, on the ground of the deeper intuition into religious truth possessed by them. The uncertainty, however, as to the actual words of Jesus and the growing impression that some at least of the writers of the New Testament did not believe in a natural immortality, but in an endless life bestowed as a free gift of God upon His children in an especial sense, have led many scholars who attach much importance to these spiritual authorities to accept the theory of a conditional immortality. The good will continue to exist; the wicked are destined for final annihilation.

Where the question of man's survival is decided in the affirmative without an appeal to authority, the reasons given are such as the inadequacy of the objections, the difficulty of accounting for certain phenomena except as manifestations of spirits, the incompleteness of the present life, and the 'intimations of immortality' to which it is felt that an objective reality must correspond. Facts are quoted that tend to show the independence of man's mind operating with great clearness, precision, and strength even in wholly abnormal physical conditions; and though, to render the argument strictly cogent, it would be necessary to prove that in these instances the brain was also affected, and that the mental power would not have been enhanced if the physical conditions had been more normal, importance seems to be rightly attached to this consideration. That the relation between mental activities and cerebral changes is very intimate is not denied; but it is thought that a distinct and separable spirit using the brain as its organ might act upon it in such a manner as to express different perceptions through different cerebral centres. The argument based on the evolution of mental life in animal and man, and the transmission of psychical as well as physical characteristics from man to man, is met by the observation that the consciousness of self, whatever its origin, is so distinguishing a mark of human nature and so intrinsically significant that a greater permanence and a loftier destiny may well be associated with it. Instead of making self-consciousness the basis of immortality, others prefer to think of the possession of a sense of right or a peculiarly high development of the moral nature as furnishing the ground for survival.

A mass of testimony is produced, ancient and modern, to show actual communication between the dead and the living. Much of this testimony comes from persons bereaved of some relative or friend whose potent personality still occupies the mind. In almost all instances the initiative is taken by the living, and the communication is mediated through a third person. A critical sifting is often impossible. Where the manifestations through a medium have been watched and studied by scientifically trained observers, there is at best only a small residue of facts that cannot be accounted for by known laws of nature. In the present state of our knowledge of psychic phenomena, it is sometimes hazardous to pronounce a judgment. The scientist is, as a rule, inclined to assume the operation of some law of nature not yet fully understood. The manifestations may thus furnish to our minds a presumption in favor of immortality, but they cannot prove it. With more effect an argument is founded upon the incompleteness of the present life. The largest part of the human race die in infancy, or before years of discretion have been reached, and it is natural to ask whether there is no outflowering elsewhere of the human life that only buds here. Even the longest lifetime raises more intellectual problems than it solves, and leaves the mind curiously looking for their solutions to the last. The moral imperfections, seen even in the best, painfully apparent in the masses of men, give the impression of something fragmentary, unfinished, partially realized. The inequalities of life as regards wealth, position, health, opportunity for self-realization, and the still more marked inequalities of character, seem to call for a readjustment, for compensations in another life. If these considerations strictly prove only a dissatisfaction with prevailing conditions, and would to some extent lose their validity as arguments in a state of society better organized, more intelligent, resourceful, and strong than the present, the shrinking from even a painless death, the sense of an inalienable personality, and the long and widespread prevalence of the hope of a future life are deemed by many to have evidential value. The fear of death may indeed be a dread of extinction, and the fear of something after death the involuntary reflection of a belief long cherished by mankind. But it is forcefully argued that a belief so strong and persistent is not likely to be a sheer delusion.

While manifestly it is not safe to conclude from the intensity and popularity of an idea that there must be an objective reality corresponding to it, and while it is especially to be considered that modern science has revolutionized that estimate of the universe, held throughout the ages, with which all eschatological speculations in antiquity were closely connected, it nevertheless seems plausible that some fact in nature's economy is reflected in the hope of immortality. That the elements composing man's body at death are imperishable and will forever continue to be integral parts of forms that manifest the eternal energy, is reasonably certain. That his psychical peculiarities survive in his offspring and in the human lives that directly or indirectly come into contact with him, is a matter of easy observation. Whether this survival in the race is endless seems to some thinkers doubtful, on the ground that the earth itself will some day have run its course and ceased to be the bearer through space of organic life. But as it is quite inconceivable that in an infinite universe, constituted, as spectral analysis shows, of essentially the same substances, a single satellite of a single sun should have produced intelligence like that of man, the secret of the earth's life may become known, and the influence of the human race, large or small, good or bad, may be felt elsewhere in the universe ere the final catastrophe comes, and even out of the death of this planet are likely to rise new forms of life.

That man will live forever in other forms of physical organization and of consciousness may therefore be regarded as exceedingly probable. Whether the consciousness of personal identity which cannot be stripped off or dissolved in the succession of fluctuating mental states and the accompanying sense of moral accountability can be fully explained as products of the brain due to the persistency of the physical type, in spite of incessant changes in the organism, may be gravely questioned. From the standpoint of idealistic philosophy this consciousness of self is interpreted as betokening the presence of a spiritual monad reflected to human sense-perception only as though it possessed a material form. But even if the ultimate reality is conceived of as an infinite, eternal, and inexhaustible energy, it does not seem to follow that each or any of its individualized expressions shares its everlasting persistence. Rather would it seem as if the reality that no longer is shadowed forth to our sense in the outward form of a man must have ceased to be what it was. The idea of a conditional immortality has received some additional strength from the doctrine of a survival of the fittest. It encounters great difficulties, however, in attempting to define what constitutes fitness. The difference between a short life on earth and an endless existence is so infinitely great that the mind shrinks from ascribing the power to determine so momentous a fate to any conviction that has been formed, or disposition that has been developed, or line of conduct that had been adhered to, during a few years of earthly life, especially in view of the enormous influence of heredity and environment. If, therefore, scientific inquiry apparently leads to a *non liquet*, and assurance based on authority can be preserved only until the authority itself is questioned, it is the more gratifying to note the important place the doctrine of immortality has had in the education of the human race in enhancing the worth of the individual and emphasizing his higher spiritual interests, in maintaining his confidence in the inherent rightness of the universe, and in training him to regulate his present conduct by considerations of the future.

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IMMORTALS, THE. A name given to the guards of the early Persian kings, forming a regiment of 10,000 foot-soldiers.

IMMORTEL, ȇ'môr'tĕl', L'. A romance by Alphonse Daudet (1888), picturing with keen insight and irony the intrigues and petty strivings of the Academic world. The chief personages are the Academician Professor Astrier-Réhu, a second-rate scholar, who finds the sources on which he has based his work to be forgeries; his false, intriguing wife; their spendthrift son; and Abel de Freydet, a candidate for the Academy.

IMMORTELLE (Fr., fem. sg. of *immortel*, immortal). A name applied to various species of Helichrysum, especially Helichrysum arenarium, which is grown extensively in France, where the flowers are made into compact wreaths for home use or for export. They are chiefly used as mortuary decorations, either in their natural color (yellow) or bleached white. Like other flowers, such as tuberoses and callas, that have been used largely for funereal decoration, immortelles have suffered in popularity, especially since the barbarous practice of dyeing them purple and vermilion, and working them into fantastic designs, came into vogue. The most striking feature of the immortelle is the one that suggested the name; the flowers, being dry and firm, are so-called 'everlasting.' They retain their natural colors for months or even years. See AMARANTH.

IMMUNITY (from Lat. *immunitas*, exemption, from *immunis*, exempt, from *in*, not + *munis*, serving, from *munus*, duty). Resistance of the living organism to infection. There is an astonishing difference in the resistance shown to the invasion by germs of disease by certain animals of allied nature. Human beings, cattle, and guinea-pigs show great susceptibility to tuberculosis; while the cat, dog, and horse resist it. Man easily becomes a victim of typhoid fever, while domestic animals never suffer from it. Immunity is either (1) natural or (2) acquired. *Natural immunity* is a congenital insensitiveness to infection or contagion which is possessed by certain individuals or families, or which exists as a racial characteristic. The same individual may be immune against a certain disease at one age and become susceptible to it at another age; thus infants are almost entirely immune against yellow fever, and but few cases occur among them. The Arab is said to be absolutely immune to typhoid fever. The Japanese are immune to scarlet fever. *Acquired immunity* is a condition of insusceptibility which results from passing through an attack of the disease, or from being inoculated with the poison of the disease, which results in a change in the blood. Immunity to yellow fever results after one attack of the disease. One attack of typhoid fever is almost a certain guard against another, a statement which is true also of scarlet fever and measles. *Experimental immunity* is acquired immunity resulting from introducing, for experimental purposes, attenuated microörganisms into susceptible animals, and thereby causing the production of immunity to virulent forms of those organisms. The house mouse and the white mouse, naturally very susceptible to anthrax, are rendered immune to this disease by receiving an inoculation of blood from a convalescent tetanic animal.

Immunity is lost or destroyed in a number of ways. It may be destroyed by (1) *variation from the normal temperature.* Pasteur found that chickens, naturally immune to anthrax, became susceptible to the disease after being plunged into a cold bath. (2) *Altering the chemical composition of the blood* by changing the diet, or by injection of drugs. (3) *Loss of strength, or exhaustion*, is a cause of loss of immunity, as Roget demonstrated by inoculating previously immune white rats with anthrax, after compelling them to work at revolving a wheel. (4) *Removal of the spleen* is followed by susceptibility to disease (Bardach). (5) *Combining various microörganisms* destroys immunity in some experimental cases.

Theories of Immunity. In 1880 Pasteur taught that the microörganism, by its growth in the body, uses up some substances necessary for its existence, and then perishes. If the removal of this substance be complete, perfect immunity results. This is the *exhaustion theory*. Sternberg combats it, saying that if it were true, we must have in each of our bodies certain smallpox material, measles material, and scarlet-fever material, etc., each of which must be exhausted by its appropriate microörganism, thus necessitating an almost inconceivably complex body chemistry. The *retention theory* was advanced in 1880 by Chauveau, who suggested that the growth of the bacteria in the body probably originated some substance prejudicial to their further development. The *phagocytosis theory* was suggested by Carl Roser in 1881, received attention from Sternberg, and also from Koch, but was not advanced with any insistence till in 1884 Metchnikoff enthusiastically championed it and gave it his name. There are two varieties of the white blood-corpuscle whose duty it is to destroy bacteria: these are the large, unicellular leucocyte, or macrophagocyte, and the smaller form, the microphagocyte. Both these forms exhibit amœboid movements, and possess the attractive force called *chemotaxis* which exists between amœboid cells and food particles. Phagocytosis is the incorporation of foreign particles by these amœboid white blood-corpuscles. Leucocytes actually take up and envelop living pathogenic organisms, as demonstrated by Koch in 1878. The *humoral theory*, suggested by Grohmann in 1884, was advanced by Buchner, who claimed that not phagocytosis, but the bactericidal action of blood-plasma, is the cause of the destruction of pathogenic bacteria. He showed that freshly drained blood, blood-plasma, as well as aqueous humor destroyed such organisms. It was shown in rebuttal that dispersion in a large amount of watery fluid causes the death of microorganisms, which grow well when allowed to remain in a close colony. The prevalent and generally adopted theory is the *antitoxin theory*, defended by Behring and Kitasato, Brieger, Tizzoni, Cattani, Roux, Vaillard, and others. According to this theory, the metabolism of bacteria, during disease, gives rise in the blood of the sick person, not only to poisonous alkaloids called *toxins* (existing either in the bodies of the bacteria or produced by them), but also to defensive proteids called *anti-toxins*, which possess the property of neutralizing the toxins. Hankin divides the antitoxins (formerly called *alexins* by Buchner) into four groups. Proteid substances that occur naturally in animals and possess the power of destroying bacteria or their products, he calls *sozins*. Similar proteids resulting from acquired immunity in animals he calls *phylaxins*. Sozins are subdivided into those which have the property of killing bacteria, or *mycosozins*, and those which neutralize bacterial products, or *toxosozins*. A phylaxin which destroys bacteria he calls a *mycophylaxin*, and a phylaxin which neutralizes their ptomaïns he calls a *toxophylaxin*. Consult: Roser, *Entzündung und Heilung* (Leipzig, 1886); Chauveau, *Traité de physique biologique* (Paris, 1901); Behring, *Die Blutserumtherapie* (Leipzig, 1892); Sternberg, *Immunity: Protective Inoculations in Infectious Diseases and Serum Therapy* (New York, 1895). For the method of securing artificial immunity by means of defensive proteids, see Antitoxin; Toxins; Serum Therapy; and Vaccination.

IMMUNITY, in feudal law, and in international law. See Feudalism; Inviolability.

IMOGEN, ĭm′ō-jĕn. The daughter of Cymbeline and wife of Posthumus, in Shakespeare's *Cymbeline*, whom her husband is made to believe false by Iachimo, but whose fidelity is afterwards proved.

IMOGENE, ĭm′ō-jēn, The Fair. The heroine of Lewis's ballad "Alonzo the Brave and the Fair Imogene."

IMOLA, ē′mō-lȧ. A walled city, on the Santerno, in the Province of Bologna, Italy, 21 miles southeast of the city of Bologna (Map: Italy, F 3). It has been the seat of a bishop since 422. It has an ancient castle, several asylums, and two theatres. It markets wine and vegetables, and manufactures leather, majolica, bricks, gunpowder, and fertilizers. Near by are mineral springs. In Roman times the city was called 'Forum Cornelii,' after its founder, L. Cornelius Sulla. Here was born Saint Peter Chrysologus, Archbishop of Ravenna, who died in 449, and the painter Innocenzo da Imola, who died about 1550. Population of commune, in 1881, 29,343; in 1901, 33,210.

IMOLA, Innocenzo da (c.1494-c.1550). An Italian painter, born at Imola. His real name was Innocenzo di Pietro Francucci, and he was the pupil of Francia at Bologna, and then studied under Albertinelli in Florence. Afterwards he went to Bologna and painted the frescoes of the "Death and Assumption of the Virgin" at San Michele (1519), also the "Madonna in Glory," and a "Madonna with Kneeling Donors," both in the gallery of that city. Among his other works are altar-pieces in the cathedral at Faenza, in Berlin, and in Munich. His best pictures are reminiscent of Raphael.

IMOSHAGH, ē′mō-shăg′. The national name of certain pastoral tribes of Tuaregs in the Sahara Desert, who are independent. See Tuareg.

IMPACT (from OF. *impacter*, *empacter*, to press close together, from Lat. *impingere*, to dash against, from *in*, in + *pangere*, to fasten). If a body in motion meets a second body—either at rest or in motion itself—there is said to be an 'impact' between them. The general principles of mechanics of course may be applied to the changes in the motion. (See Mechanics.) The geometrical sum of the linear momentum of the two bodies is not changed by the impact; nor is the sum of their kinetic energies, provided they are perfectly elastic. Consider the two bodies as moving along the same horizontal line. Let their masses be m_1 and m_2 and the velocities of their centres of inertia before and after impact be v_1 and v_2 and V_1 and V_2, respectively. Then, for all bodies

$$m_1v_1 + m_2v_2 = m_1V_1 + m_2V_2.$$

(This law was given by Wallis, Wren, and Huygens almost simultaneously, 1668. The first applied it to inelastic bodies; the last two to elastic ones.) If the bodies are absolutely inelastic, $V_1 = V_2$; if they are perfectly elastic,

$$\tfrac{1}{2}\,m_1v_1^2 + \tfrac{1}{2}\,m_2v_2^2 = \tfrac{1}{2}m_1V_1^2 + \tfrac{1}{2}\,m_2V_2^2;$$

if they are imperfectly elastic and of the same material, Newton has shown that

$$\frac{V_1 - v_1}{v_2 - V_2} = e$$

a constant for a given kind of material, which is called the 'coefficient of restitution.'

IMPALE (from Fr. *empaler*, It. *impalare*, ML. *impalare*, to impale, from Lat. *in*, in + *palus*, pole). In heraldry, to arrange two coats of arms side by side in one shield divided per pale. It is usual thus to exhibit the conjoined coats of husband and wife, the husband's arms occupying the dexter side or place of honor, and the wife's the sinister side of the escutcheon. A husband impaling his wife's coat with his own is not allowed to surround the former with the collar or insignia of any order of knighthood to which he may belong. Bishops, deans, heads of colleges, and kings of arms, impale their arms with their insignia of office, giving the dexter side to the former. In early heraldry, when two coats were represented in one shield side by side, only half of each was exhibited, an arrangement which had been called dimidiation (q.v.). Sometimes the one coat only was dimidiated. A reminiscence of dimidiation is preserved in the practice of omitting bordures, orles, and tressures in impaled arms on the side bounded by the line of impalement.

IMPAL'LA (African name). An antelope. See PALLA.

IMPANATION (Fr. *impanation*, Port. *impanacão*, It. *impanazione*, from Lat. *in*, in + *panis*, bread). A word coined in the Middle Ages to indicate a modification of the theory of transubstantiation. Formed upon the model of the word 'incarnation,' it ought to denote that the divine Logos took upon Himself the elements of the bread and wine of the Eucharist, just as He did humanity in the Incarnation. But it was used to denote the view that instead of a transubstantiation by which the substance of the bread and wine became the substance of the body and blood, there was in the Eucharist an assumption by the whole Christ, body as well as divine Logos, of the bread and wine, so that He was wholly present in them. This scarcely differs from Luther's personal view, which was that of the "sacramental permeation of the substance of the bread by the substance of the body," etc., and he was charged by Bellarmine and other Roman Catholics with reviving the old error of impanation. The official doctrine of the Lutheran Church, however, is that of the "sacramental coexistence at the same place of the two substances, both continuing to exist in their unmodified integrity." See LORD'S SUPPER; TRANSUBSTANTIATION.

IMPARLANCE (OF. *emparlance*, from *emparler*, to talk, from *en*, in + *parler*, to talk, from ML. *parabolare*, to discourse, from Lat. *parabola*, parable, from Gk. *παραβολή*, *parabolē*, comparison, from *παραβάλλειν*, *paraballein*, to place beside, from *παρά*, *para*, beside + *βάλλειν*, *ballein*, to throw). In common-law pleading, an allowance of time to the defendant in a civil suit to put in his defense. As the name indicates, the grant of time was originally made to enable the defendant, before pleading, to talk with the plaintiff, with the view of coming to an amicable understanding with him. Later, in certain classes of cases, the defendant was entitled to demand one imparlance (*licentia loquendi*) for this purpose, and this practice, in course of time, became a mere device for securing a reasonable time in which to plead. The term is not in general use in this sense in the United States. See PLEA; PLEADING. Consult Blackstone, *Commentaries on the Laws of England*.

IMPAS'TO (It., covered with paste). The name given to the practice of painters who lay on their color with solidity and thickness. Certain schools at one time loaded with color the light portions of their picture, and left the shadows thinly painted. In this way they thought to secure transparency, as it was called, in the shadows. The practice to-day, however, is to attain transparency in shadows by their true relation to the light parts of the picture, and this is done by painting all parts with equal thickness of pigment.

IMPATIENS. See BALSAM.

IMPEACHMENT (OF. *empeschement*, Fr. *empêchement*, hindrance, from OF. *empescher*, Fr. *empêcher*, to hinder, from ML. *impedicare*, to entangle, fetter, from Lat. *in*, in + *pedica*, fetter, from *pes*, foot). The act of calling a person to account for some misconduct, or of discrediting a witness, a document, or a record. Impeachment of waste is an ancient statutory proceeding instituted to restrain and punish the commission of acts of waste by tenants for life or years. (See IMPEACHMENT OF WASTE, and WASTE.) The manner in which a document or record or witness is impeached, and the legal effect of such impeachment, are explained in the article on EVIDENCE.

There remains for our present consideration the peculiar method, known as impeachment, of prosecuting certain public offenders. In England it differs from the ordinary criminal prosecution in two respects: (1) the prosecutor is the House of Commons, and not the Crown; (2) the trial court is the House of Lords, and not an ordinary judiciary tribunal. In the United States an impeachment is generally instituted and prosecuted by the Lower House of Congress or of a State Legislature before the Upper House or Senate, although a few of our States provide for impeachments in the ordinary courts of justice.

This method of prosecuting criminals was employed for the first time in the case of Lord Latimer and others, who were accused of different kinds of frauds and malpractices connected with the revenue during the latter part of the reign of Edward III., and who were found guilty and condemned to imprisonment and removed from office. The proceeding is one of the monuments of the Good Parliament of 1376. Several other cases of impeachment of crime followed; but after 1459 acts of attainder (see ATTAINDER) took the place of impeachments for nearly two centuries. Under the Stuarts, however, Parliament again returned to impeachments as an effective method of dealing with officers of the Crown who were corrupt or oppressive. In 1621 Sir Giles Mompesson and Lord Bacon were impeached and convicted, removed from office, and heavily fined, for gross official misconduct. Since that date there have been fifty-two cases of impeachment in England, of which number but one has occurred within a hundred years, and that one in 1805. The proceeding is practically obsolete there.

In the United States, however, it is still a live and vigorous institution. The court for the trial of impeachment is accounted the very capstone of our judicial systems, Federal as well as State. Its existence is secured and its organization is regulated by national and State constitutions. For example, the organic law of the Union provides that "the House of Representatives shall have the sole power of impeachment" (Art. I., Sec. 2, cl. 5), and "the Senate shall have the sole power to try all impeachments. When sitting for that purpose," it is declared, "they shall be on oath or affirmation. When the President of the United States is tried, the Chief Justice shall preside; and no person shall be convicted without the concurrence of two-thirds of the members present. Judgment in cases of impeachment shall not extend further than to the removal from office and disqualification to hold and enjoy any office of honor, trust, or profit under the United States, but the party convicted shall nevertheless be liable and subject to indictment, trial, judgment, and punishment, according to law." (Art. I., Sec. 3, cl. 6 and 7.) The Constitution further provides that "the President . . . shall have power to grant reprieves and pardons for offenses against the United States, except in cases of impeachment" (Art. II., Sec. 2, cl. 1); and again, "the President, Vice-President and all civil officers of the United States, shall be removed from office on impeachment for, and conviction of, treason, bribery, or other high crimes and misdemeanors." (Art. II., Sec. 4.) Similar provisions are contained in nearly every State constitution, although a few States remit impeachment trials to the ordinary courts of justice.

It will be observed that this extraordinary proceeding is limited by the Federal Constitution to the punishment of Federal officers. Can a Federal officer escape impeachment by resigning his office? The Senate decided in the case of Belknap, by a vote of 37 to 29, that he cannot. On the other hand, the Supreme Court of Nebraska has held that the prime object of impeachment proceedings is to protect the State from official misconduct, and that as soon as an officer resigns, the reason for resorting to these proceedings ceases. Thereafter, the offender is to be prosecuted like any other criminal by indictment and trial in the proper judicial tribunal.

Differences of opinion have developed, also, in this country concerning the nature of impeachable offenses. According to one view, only such official misconduct as renders the wrongdoer liable to indictment will warrant an impeachment; while another view is that this proceeding was intended to be very elastic and comprehensive, and to be applicable to every sort of official misdemeanor which is subversive of any fundamental or essential principle of government or highly prejudicial to the public interests. This view was adopted by the House of Representatives in preparing its articles of impeachment of President Johnson, and has been approved by the Supreme Court of Nebraska. It has been embodied in the constitutions of some of the States.

The literature upon this topic is quite extensive, both in England and in this country. See Blackstone, *Commentaries;* Anson, *Law and Custom of the Constitution* (Oxford, 1886); Stephen, *History of the Criminal Law of England* (London, 1883); May, *Parliamentary Practice* (10th ed., London, 1901); Pike, *Constitutional History of the House of Lords* (London, 1894); Poore, *Federal and State Constitutions* (Washington, 1877); 6 *American Law Register,* N. S. 257, 641; *State* v. *Hastings,* 37 Nebraska Reports, 96 (1893); Story, *Commentaries on the Constitution* (Boston, 1882); *Addison Trial* (Lancaster, 1803); *Chase's Trial* (Baltimore, (1805); *Peck's Trial* (Boston, 1883); *Prescott's Trial* (Boston, 1821); *Impeachment of President Johnson* (Washington, 1868); *Belknap's Trial* (Washington, 1876); Mechem, *On the Law of Public Offices and Officers* (Chicago, 1890).

IMPEACHMENT OF WASTE (liability for waste). An expression of English law used to denote the liability of tenants for life or years for waste committed by them upon the estate. The phrase is commonly employed in connection with a lease of land for life or for a term of years, when an estate is given to such a tenant, "without impeachment of waste." He is then entitled to cut timber, and do many things on the estate which otherwise he would be unable to do. The privilege so granted is, however, not unlimited, but is confined to such reasonable use of the land as is included within the description of 'ordinary waste,' such as the cutting of timber for building and repairs, the improvement of the estate, etc. If the tenant abuses the right and attempts to cut down ornamental timber, for example, or deface the family mansion, the Court of Chancery will interfere by injunction to restrain the unauthorized waste. See WASTE.

IMPENDING CRISIS, THE. See HELPER, HINTON ROWAN.

IMPERATIVE, CATEGORICAL. See CATEGORICAL IMPERATIVE; ETHICS.

IMPERATIVE MOOD. See CONJUGATION.

IMPERATOR. See EMPEROR.

IMPERIAL CHAMBER (Ger. *Reichskammergericht*). One of the two highest courts of the Holy Roman Empire, coördinate with the Aulic Council (q.v.). It was created in 1495 by the Emperor Maximilian under pressure of the princes of the Empire, whose influence was greatly strengthened by the erection of the new tribunal. It was composed of a president nominated by the Emperor, two vice-presidents, and a number of associate judges, varying at different times from sixteen to fifty, selected partly from among men learned in the law and partly from the ranks of the nobility. Its jurisdiction included primarily all cases involving the princes of the Empire, but it sat also as the highest court of appeal in civil cases involving the interests of the member of any estate. It also offered redress for any refusal, delay, or miscarriage of justice on the part of any inferior court. Its sessions were held at Frankfort, Speyer, and, after 1693, at Wetzlar. It exercised a profound influence on the development of the civil codes in the various territories of the Empire. See the article HOLY ROMAN EMPIRE.

IMPERIAL CITY, THE. A title frequently given to Rome.

IMPERIAL EAGLE. See EAGLE.

IMPERIAL FEDERATION. A plan to unite the different parts of the British Empire more closely. At present the only formal tie between the various parts of the British Empire is the Crown. Many of these parts being so distant, of such diverse local interests, and having no representation in the Imperial Parliament, must naturally drift into complete independence, unless some reconstruction of the British Constitution be effected which shall retain and strengthen the interests of the self-governing colonies in the Empire. For several years this question has occupied the minds of British statesmen. In 1884 a gathering of leading members of both the Liberal and Conservative parties, in London, under the presidency of the Right Hon. W. E. Forster, resulted in the formation of the Imperial Federation League. A practical scheme of federation, prepared by a special committee of the League, was presented in 1892. It recommended the establishment of a council of the Empire, on which the chief self-governing colonies should be represented, including India and the Crown Colonies. This Council should deal with Imperial defense, to which each part of the Empire should contribute. The adoption of this report marks the end of the stage of general discussion without any definite plan, and the beginning of the period for taking steps to bring the matter to an issue. As the work for which the League was founded belonged rather to the first than the second stage, and as the members differed as to the best plan to be followed, it was decided to dissolve the League at the end of 1893, in order that there might be complete freedom in deciding on practical steps. Its place was taken by several organizations, among which are The United Empire Trade League, The British Empire League, The Imperial Federation (Defense) Committee, and The Unity of the Empire Association. Besides these there are many societies in the various colonies.

A conference which met in Ottawa June 28, 1894, composed of delegates from nearly all the self-governing colonies, marks a step in the progress of the movement. The object of the meeting was to promote the development of trade within the Empire by means of improved intercolonial communication. The keynote of the discussions was loyalty to the mother country and a determination to maintain intercolonial solidarity. Thus the conference served to bring about a mutual acquaintanceship and to arouse a feeling of intercolonial kinship. There are several practical difficulties to be encountered. Critics of the project doubt if the mother country would permit herself to be outvoted by a combination of the colonies, or whether each part would be willing to aid the others in matters not directly affecting itself. The various colonies have different tariff systems, some being strongly protectionist, and it is a question whether these last would agree to the free-trade preferences of the mother country, or whether England would modify her policy to please them. The basis upon which India could be included within the union is also a matter frequently discussed. These and other problems, it is asserted, must be solved before the federation can be accomplished.

On the other hand, the project has received the warm approval of a large section of the British and colonial press, and of men of such widely differing political views as Mr. Forster, Lord Randolph Churchill, Sir John Lubbock, and Mr. Cecil Rhodes. The growing intimacy between the parts of the Empire, as shown by the conference of 1894, and the gradual reduction of the barriers of time and distance, augur well for the success of the movement. The existence of a real and practical, though not formal, union is demonstrated by the aid furnished to the mother country in the Transvaal War of 1899-1902, and in the Chinese fighting of 1900. Many persons see a strong tendency toward ultimate Imperial federation in the recent federal unions of Canada (q.v.) and Australia. See AUSTRALIAN FEDERATION.

IMPERIAL INSTITUTE OF THE UNITED KINGDOM, THE COLONIES, AND INDIA. A memorial of the Queen's Jubilee of 1887, which is a public institution in South Kensington intended to contain "sample collections of the natural products and resources of every portion of the British Empire, so arranged and displayed as to be of practical benefit to commercial business men, and to allow of scientific research by every class of students." It is furnished, therefore, with laboratories and with reading and lecture rooms as well as with exhibitory departments. The University of London is now housed also in the buildings of the Imperial Institute. For a description of the building, with illustrations, consult in *Magazine of Art*, March, 1890, an article by Sir Somers Vine.

IMPERIALISM. A term originally applied to the character and spirit of that form of government known as an empire (q.v.), and connoting absolute power vested in the hands of a single ruler. More recently the term has been generally used to describe the policy, pursued by various nations, of establishing 'world powers' through the extension of their rule over other and especially inferior races of mankind, and, sometimes, through the acquisition, on whatever motive, of new territory lying outside their 'natural' boundaries. The policy, when logically carried out, results in the establishment or maintenance of colonies or outlying dependencies. In Great Britain the term is sometimes applied to the doctrine which calls for the closer union, into a so-called Imperial Federation, of the component parts of the British Empire. With reference to the questions of expansion of territory and extension of power, there has been much discussion in recent years, especially in Great Britain and the United States. In the former country those favoring such a policy are popularly known as 'Jingoes,' and those opposing it as 'Little Englanders.' Each acquisition or attempted acquisition of new outlying territory by the United States has met with much opposition, and the opposition was particularly pronounced at the close of the Spanish-American War, when a group of citizens, who soon came to be known as 'Anti-Imperialists,' vigorously contended against the acquisition by this country of the Philippines and Porto Rico. By various political leaders and a large number of voters 'imperialism' was regarded as the 'paramount' issue in the Presidential campaign of 1900.

IMPERIAL MOTH. The largest of the 'royal moths' (*Basilona imperialis*), sulphur yellow marked with purplish brown. The wings expand from four to five inches; the larva is thinly clothed with hairs and bears spiny horns on the second and third segments. It feeds on the hickory, butternut, and other forest trees.

IMPERIAL ORDER OF SERVICE. A new order instituted in London June 26, 1902, by King Edward VII., to confer honor on those who have held continuous office under the British Crown either in England or in the colonies. The order consists of a sovereign and companions. Though the number of companions is unlimited, the order is practically confined to persons who have been employed in the various branches of the British Civil Service for at least forty years. Up to January 1, 1903, the order had been conferred on about one hundred and five gentlemen.

IMPERIAL WOODPECKER. See Ivory-bill.

IMPERIUM (Lat., power, jurisdiction). A term applied to the sovereign power of a Roman magistrate when in command outside of Rome. Thus, a Roman consul, when operating in war, was invested with the power, *imperium*, that in Rome was the inalienable prerogative of the *Senatus Populusque Romanus;* and he was known as *imperator*, general-in-chief. When Augustus took under his own control all the important functions of the State, the republic merged into a monarchy, the *imperium* became the exclusive prerogative of the monarch, and *imperator* passed to its modern meaning of 'emperor.'

IM'PETI'GO (Lat., from *impetere*, to attack, from *in*, in + *petere*, to seek). A disease of the skin. The term was formerly applied to many different diseases of the skin which were characterized by pimples, pustules, and scales. In modern times Willan restricted the term to a disease of the skin, characterized by an eruption of small itching pustules, single or in groups, terminating in scaly crusts of a yellowish color. Hebra and more recent writers discard the term, and classify the old impetigo as a form of eczema (q.v.). Tillbury Fox, of London, describes impetigo contagiosa as an acute pustular, contagious skin disease,.during which the patient suffers from fever. with vesicles and pustules on the face and hands, and thence extending to other parts of the body and followed by the production of yellowish crusts. Impetigo herpetiformis is a similar, noncontagious eruptive dermatosis, occurring in pregnant women, attended with grave general symptoms. Impetigo rodens is either cancer or syphilis. For treatment of impetiginous eczema, see Eczema.

IMPEY, ĭm'pĭ, Sir Elijah (1732-1809). An English jurist, Chief Justice of Bengal, born at Hammersmith. He was educated at Westminster School and Trinity College, Cambridge, and was called to the bar in 1756. He was counsel for the East India Company in 1772, and two years later was knighted and sent out to Calcutta as the first Chief Justice under the new regulating act. He naturally sided with his old school-fellow, Warren Hastings. in that Governor's political troubles, and this course of conduct, together with his condemning to death the famous forger Raja Nanda Kumar, brought about his own recall and impeachment (1783); but he was discharged with honor, having been revealed as an amiable and upright judge, perhaps a trifle vain and too easily led by Hastings. Impey was elected member of Parliament for New Romney in 1790, but, although he held his seat until 1796, retired to the country in a couple of years, and spent his latter days in educating his family and enjoying the society of his friends.

IMPEYAN PHEASANT. See Pheasant.

IMPLEMENTS, Agricultural. A loose term applied to all implements and tools used in farming, not only in the tilling of the soil, but in the later preparation of the crop for market. Doubtless the first tools used were such as required only human strength in their manipulation. The crude spade, hoe, rake, sickle or scythe, and the flail of the ancients are the prototypes of the modern plow, cultivator, harrow, self-binder, and threshing-machine. After animals were subjected by man, the primitive plow and harrow appeared. At first these were branches of trees; the former a crotched stick drawn through the ground, the latter a twiggy limb dragged over the surface. Cultivators and other implements for clearing the ground of weeds, for the occasional stirring of the ground while under crop, and for earthing up crops are all modern inventions. Especially during the nineteenth century were improvements made in almost every kind of farm implement. Indeed, not a few first appeared during that period, notably the perfected seed-drill, reaper, and self-binder. The threshing-machine has not only supplanted the flail and the use of animals in treading out the grain, but has also rendered obsolete the ancient methods of winnowing away the chaff. In short, every necessary operation of the farm is now performed with some implement or machine specially adapted to the purpose, and horse, steam, and in some instances electric power, have supplanted manual labor as far as such substitution has been deemed feasible. Since the publication of Thomas's *Farm Implements and Machinery* (1859 and 1869), a few American books have appeared which illustrate and describe many farm conveniences and appliances; but improvements in farm implements have been so numerous and important, and the applications of science so striking, that there is great need of a work which shall deal with fundamental principles. See Harvest and Harvesting; Threshing, etc.

Consult: Bailey, article "Tools," in *Cyclopedia of American Horticulture* (New York, 1900); Myrick, *Farm Conveniences* (New York, 1884); Martin, *Farm Appliances* (New York, 1887).

IMPLU'VIUM (Lat., receptacle for rain-water). A tank or cistern in the centre of the hall or atrium of a Roman house. In the examples which remain at Pompeii the impluvium is generally formed of marble. It is placed immediately under the unroofed part of the atrium, and is intended to receive the rain which runs down from the roof through the opening or compluvium. The impluvium was frequently adorned with a fountain, and with busts, statues, and vases, and formed a very peculiar and interesting feature in the house. The term was also applied to the central open space of the atrium, even if unprovided with a collecting basin.

IMPOON, ĭm-po͞on' (Zulu name). One of the duikers (*Cephalolophus mergens*), a small antelope, very plentiful in South Africa, in wooded districts. See Duiker.

IMPORTS AND EXPORTS. In a general sense, imports and exports are goods which are conveyed across the boundaries of a region which is economically a unit. Thus we read of the imports and exports of mediæval cities, and the intercolonial trade in America before the Revolution is classified in imports and exports. Since, however, almost all of our knowledge of imports and exports is connected with the collection of duties from them, it has become customary to apply the terms to goods carried into or away from regions which are units politically, in which no part levies discriminating duties against goods from another part. The trade between different parts of Australia, which formerly figured in statistics of imports and exports, has ceased to be so classed since the federation of the Australian colonies. A mere customs union of independent political units, however, would not change the character of the trade among its members.

The formation of extensive empires and federations which has taken place in modern times would in itself have largely diminished imports and exports. So also would the great diversification of industry which has marked the recent economic history of the chief modern States. Agricultural countries are rapidly becoming manufacturing countries also, and hence have less reason to export raw produce and import manufactures. On the other hand, the great cheapening of transportation and the development of a wider range of wants have had a tendency greatly to increase imports and exports. How greatly the latter set of forces have overbalanced the former may be seen by comparing the statistics of foreign trade of a hundred years ago with those of the present. See Commerce.

Since the opening of the modern epoch there has existed a feeling that imports are injurious to a country, while exports are advantageous to it. Early statesmen believed that imports tended to drain a country of its bullion, while exports tended to restore that form of wealth. Hence the numerous regulations of the mercantile period which aimed to discourage importation and encourage exportation. The special character of English imports and exports of the time assisted in developing this prejudice against imports. England largely exported wool and corn—commodities of high utility—and imported chiefly fine wares and articles of luxury, which were regarded by statesmen as injurious. The physiocratic school of writers, on the other hand, argued that since exportation of useful articles encouraged their production, it was to the advantage of a country to import its luxuries and devote itself to production of necessaries. But this point of view has never been widely adopted by practical statesmen.

Prejudice against imports still exists; but it is chiefly on the ground that importation tends to diminish the employment of labor and capital within a country. Exports are regarded with favor as encouraging industry. Economists have shown that exports and imports have an irresistible tendency to balance each other. An excess of imports, followed by a drain of specie, lowers prices in the importing nation, and so encourages exportation. On the other hand, development of export trade must sooner or later result in an inflow of specie, higher prices, and consequent importation. The advantages of foreign trade in its entirety should, therefore, be the subject of study, not the advantages and disadvantages of the correlative phenomena that compose it.

In practical politics much stress is still laid upon the character of imports and exports. It is commonly regarded as highly desirable that a nation should export manufactures, and that its imports should as far as possible be raw materials. Manufacturers draw less upon the natural resources of a country and more upon the industry of its people. It is obvious, however, that a country with unique natural resources may attain a higher standard of well-being if it devotes its labor and capital to the exploitation of those resources, instead of endeavoring to produce manufactures in which it would have no relative advantage over other countries.

It has been said that there is a natural tendency for imports and exports to balance each other. This is true, however, only with qualifications. The total value of imports of the world must naturally exceed that of exports, since the cost of carriage enhances the value of goods transported from one nation to another. A nation like England, which does a more than proportionate part of the world's carrying trade, can permanently import more than it exports; while the United States, since it carries only a small part of its imports and exports, must permanently have a balance of exports. Again, a nation may invest the wealth gained by exportation in foreign enterprises, and will therefore have no corresponding surplus of imports until the returns from such enterprises begin to come in. Thereafter it may receive a permanent surplus of imports. So England, having invested heavily in other countries, normally shows a great excess of imports over exports, as does also France, while the countries which are heavily indebted to foreign capitalists export as a rule far more than they import. See Commerce; International Trade; Balance of Trade.

IMPOST (Fr. *imposte*, from Lat. *impositus*, p.p. of *imponere*, to place upon, from *in*, in + *ponere*, to place, from *po-*, Gk. *ἀπό*, *apo*, away + *sinere*, to allow). The point where an arch rests on a wall or column, or the part of the structure from which it springs. It is usually marked by horizontal moldings; but sometimes these are absent, especially in Gothic architecture, where different forms of impost are used. These have been classed as—first, the continuous impost, where the arch moldings are carried down the pier; second, the discontinuous impost, where the arch moldings abut and are stopped on the pier; third, the shafted impost, where the arch moldings spring from a capital, and are different from those of the pier, the form used in best Gothic; fourth, the banded impost, where the pier and arch have the same moldings, but the impost is marked by a band of horizontal moldings, as is frequently the case in Italian-Gothic buildings. Two adjoining arches often spring from the same impost block. The member which receives this name was unknown before mediæval architecture.

IMPOSTORS, The Three (Lat. *De Tribus Impostoribus*). The name given to a work alleged to deny all divine revelation, characterizing the three great founders of religions—Moses, Jesus, and Mohammed—as impostors. Though it is often mentioned since the tenth century, and attributed to heretics of various ages and various degrees of eminence, no authentic copy is known to have ever been seen. A book bearing this title, and professedly published in 1598, was reprinted by E. Weller, with German translation, Leipzig, 1846; without the translation, Heilbronn, 1876. In the eighteenth century renewed attention directed to the subject by the spread of infidelity caused the appearance of an apocryphal edition, which has been frequently reprinted.

IMPOTENCY (from Lat. *impotentia*, inability, from *impotens*, powerless, from *in-*, not + *potens*, able, from *potis*, powerful; connected with Lith. *patis*, Skt. *pati*, lord). As a legal term, an incurable incapacity that admits of neither copulation nor procreation. It is a ground for divorce by either spouse if it existed at the time of marriage and is incurable, whether it results from a defect caused by nature, or by accident, or by the acts of the party. It has been held that "where impotency is simply the result of old age, the marriage is still binding; that a man of sixty who marries a woman of fifty-two should be content to take her *tamquam soror*." The burden of proving impotency is upon the party alleging it as a ground for a divorce. Consult the authorities referred to under DIVORCE; HUSBAND AND WIFE.

IMPOUNDING. The placing in a pound goods which have been taken by distress (q.v.), or cattle which have been taken damage feasant or found astray. See POUND; ESTRAY.

Also, the retention of a deed or other legal document in the custody of a court in which it is produced. This may be done where the instrument is suspected of being forged, or is otherwise of such a character as to satisfy the court that it may be used as the basis of a criminal prosecution. It is then impounded by order of the court, in order that it may be available when required for that purpose.

IMPRESSIONIST SCHOOL OF PAINTING (from Lat. *impressio*, from *imprimere*, to impress, from *in*, in + *premere*, to press). A group of painters who endeavor to render the impression of an object, or being, exactly as it is in nature. Strictly speaking, every painter is an impressionist, in so far as he renders his own impressions, and the term 'Luminists' has been proposed by Van Dyke as more appropriate, since the school is mainly concerned with rendering light. They constitute a branch of the Realist school, and are also called Naturalists, corresponding to the modern Naturalist schools of sculpture and literature. They differ from Realists like Courbet in that they conceive nature to present a series of flat, colored surfaces, and not figures in rounded contours. Their pictures are marked by an absence of modeling.

The chief object of the Impressionists is to render the effects of light. They paint everything in full light, and condemn the practice of painting in the studio as giving untrue tones. All their pigments are light. Bright colors are placed side by side, and the school avoids the middle tones by which earlier painters achieved harmony of color. Their works, being momentary impressions, are marked by great rapidity of execution, and seem sketchy in character. Indeed, the members of the school have justly laid themselves open to the criticism of exhibiting unfinished sketches for pictures. So great a painter as Monet, for example, held an exhibition of studies of poplars seen at different times of day and seasons of the year. Closely inspected, their paintings seem mere blotches of color roughly applied; but seen at a distance they present pictures strikingly true to nature. Their rapidity of execution enables the Impressionists to portray motion and the nuances of expression to an extent not previously attained. Their figures are real men and women in the actions of daily life, not models posed in a studio. They took the final step in the liberation of modern art from ancient tradition in color—a revolution begun by the Romanticists under Delacroix, and continued by the Realists under Courbet. Being the latest school, they have also come nearest to solving the specific problem of nineteenth-century art—the representation of light, color, and moving life.

The Impressionists found their way to public favor very slowly. At first they were the subject of much ridicule. Manet, the founder of the school, had to exhibit his first Impressionist picture in the Salon des Refusés in 1863. A powerful factor in their progress to public favor was their championship by Zola, whose articles in behalf of Manet attracted great attention. They were much aided by the picture dealer Durand-Ruel, who, at a time when they were generally condemned, held exhibitions of their work side by side with that of the Barbison masters. It was not until the early seventies that critics and the general public began to take them seriously. Painters, however, were quicker to recognize the progress in color and atmosphere which Impressionism represents. Its work is quite generally accepted and followed, and its permanent influence has been to raise the pitch of light in present painting. It is, however, a question whether there will not be a reaction in favor of greater form and solidity in painting than is the present practice.

The chief French representatives of Impressionism are Monet, the present head of the school, and Sisley, in landscape; Degas, Raffaelli, and Pissaro, in figure and genre painting. Its influence is strongly felt at Munich and Glasgow, and in the United States, where the chief representatives are Weir and Twachtmann. The late Theodore Robinson was also a prominent exponent of the school. Consult: Duranty, *La nouvelle peinture* (Paris, 1876); Duret, *Les peintres impressionistes* (ib., 1878); Lecomte, *L'art impressioniste* (ib., 1892); Muther, *History of Modern Painting* (London, 1896).

IMPRESSMENT. A procedure formerly adopted in Great Britain to obtain additional seamen for manning the navy. It was admitted to be unjust to the individual, but was made legal on the ground that the country had the right in time of war to the services of any individual. All seafaring men, except masters and mates of merchant vessels, watermen-apprentices, and certain other exempted persons, were liable to be forcibly seized, taken on board men-of-war, and compelled to serve. The practice was extended to cover men on board vessels in other than home waters. As the British Government claimed a right to the services of her seamen wherever found, men were seized on board foreign merchant vessels, and even on men-of-war which were too weak to resist. Similarity of language and the fact that many American seamen were of British birth caused the United States to be the greatest sufferer from the British press-gangs, and eventually this grievance became a leading cause of the War of 1812. It is stated that the number of impressed Americans serving in British ships between the years 1802 and 1812 was seldom less than the total enlisted force of the United States Navy at the time, and at the beginning of the war more than 2000 Americans were discharged into prison ships for refusing to fight against their own country. In the treaty of peace Great Britain did not formally give up her claim to the right of impressment as respected seamen in American ships, for the subject was not mentioned; but the claim of the United States was tacitly admitted, and no further attempts were made to impress men from American ships.

IMPRISONMENT (from *imprison*, OF., Fr. *emprisonner*, from *en*, in + *prison*, prison, from Lat. *prensio*, arrest, from *prehendere, prendere*, to seize). The restraint of a person's liberty for any cause whatever, whether by authority of the Government or in defiance thereof. In the latter case it is 'false imprisonment' (q.v.). It does not necessarily imply a prison with bolts and bars, but may be exercised by any use or display of force, lawfully or unlawfully, in the open street. A man becomes a prisoner, wherever he may be, by the mere word or touch of a duly authorized officer directed to that end. Usually, however, imprisonment is understood to imply an actual confinement in some jail or prison employed for the purpose according to the provisions of law. The power to imprison is in many cases inherent in courts or magistrates, and in others conferred upon them by statute, and it may be employed in civil as well as criminal proceedings. Imprisonment for debt, once universal in this country, under the operation of the English common law, is now generally abolished by statute, except in cases where the action of the debtor is tainted by fraud, or he is reasonably suspected of an intention to avoid his debts by concealing his property, or removing that and himself from the State. Witnesses whose testimony is necessary for the conviction of a criminal often are imprisoned to prevent their escape from the jurisdiction of the court. Persons accused of crime are either confined till the day of trial or released on bail, according to the gravity of the offense. Courts have the power to imprison for contempt of their authority, and persons found guilty of crime are imprisoned for periods definitely fixed by statute or by the judgment of the court. The confinement of lunatics in asylums appointed for the purpose is not here considered, as such asylums are not usually regarded as prisons. A person who wrongfully or illegally deprives another of liberty may be sued in a civil action for false imprisonment by the person aggrieved, or prosecuted as for a criminal offense. A prisoner desiring release is entitled to a writ of *habeas corpus* to obtain the judgment of a competent court as to the legality of his imprisonment. See Arrest; Debtor; Duress; Punishment; Bail; Debt; etc.

IMPROBATION (Lat. *improbatio*, disapproval, from *improbare*, to disapprove, from *in-*, not + *probare*, to approve, from *probus*, good). In Scotch law, the title of a proceeding for setting aside a deed or other instrument, which is apparently valid and probative, on the ground of forgery or falsehood. It belongs to the class of 'rescissory' actions, and is equivalent to the jurisdiction exercised by the courts of equity in England and America, in setting aside and canceling legal instruments, and in removing clouds on title. See Equity; Fraud; Mistake.

IMPROMP'TU (Lat., in readiness). In music, a short extemporaneous composition. Also a title given to compositions for pianoforte that have little thematic development.

IMPROMPTU DE VERSAILLES, ăN'prōN'-tu' de vȧr'sȧ'y', L'. A play by Molière (1663), in which he attacked the critics of his *Ecole des femmes*.

IM'PROPE'RIA (Lat. nom. pl., reproaches). A series of antiphons and responses which are sung in the Catholic Church on Good Friday, as a part of the mass of the presanctified. Ever since 1560 Palestrina's famous Improperia have been sung in the Sistine Chapel in Rome.

IMPROPRIATION (from ML. *impropriatio*, from *impropriare*, to impropriate, from Lat. *in*, in + *proprius*, own). A term used in England, signifying the transfer to a layman of the revenues of a benefice to which the cure of souls is annexed, with an obligation to provide for the performance of the spiritual duties attached to the benefice. The spiritual duties are discharged by a clergyman, who is called a vicar, and who receives a certain portion of the emoluments of the living, generally consisting of a part of the glebe-land of the parsonage, together with what are called the 'small tithes' (i.e. tithes of hops, potatoes, and the like farming products) of the parish.

IMPROVISATION (from Lat. *improvisus*, unforeseen, from *in-*, not + *providere*, to foresee, from *pro*, before + *videre*, to see). The art of producing without previous preparation a poem, or a musical composition. Oratory, although in its original form it is founded on spontaneous efforts, is not ordinarily considered under the head of improvisation; but poetry and music, while subject to inspiration, are rather dominated by their complexity, and improvisation in these branches represents a peculiar and unusual ability. Poetry and music, like the dance and music, were inseparable in their early history; the Egyptian priests chanted improvised hymns to their deities; while in Greece, the real home of improvisation in antiquity, it was customary for poets to recite impromptu verses to the accompaniment of the lyre. In later Roman times Archias, the friend of Cicero, Publilius Syrus, Ovid, and Statius, were famous improvisatori. But as in the course of centuries languages grew more compact, and as less license was allowed, improvisation almost died out among civilized nations. Among savage peoples it has always been practiced. From the decline of Rome to the ninth century improvisation as an art was practically unknown. Then, however, came the renaissance, and the troubadours, the trouvères, the minnesingers, and the meistersingers (qq.v.) followed each other in rapid succession. Italy was quick to take advantage of the adaptability of her language, and the courts of Naples, Milan, and Ferrara became poetical centres from which the new art spread throughout the Peninsula. In Germany and in France improvisation was soon superseded by careful composition, but in Spain, and especially in Italy, it lingered long. Petrarch, in the twelfth century, gave a great impetus to improvisation, and down to the present day in Italy it has played an important rôle in the imaginative life of the poorer classes. Improvisation is by no means limited to brief poems of a few verses, and of simple structure, but is often carried on in complicated metres, and to great length. Some of the most famous of the Italian improvisatori have been: the Venetian Leoniceno (died 1524); Serafino of Aquila (died 1500); Accolti of Arezzo (sixteenth century); Metastasio (q.v.), who, however, soon abandoned the art; and Tommaso Syrici (died 1836). In Corsica and Sardinia there are many women (improvisatrices) who improvise long memorial poems at funerals. Among the best-known improvisatrices may be mentioned Magdalena Fernandez (died 1800), Signora Mazzei (born c.1800); and Giovannina Milli.

In music, improvisation is the art of performing extemporaneously upon an instrument. A given theme or themes may be developed in strict form, or the performer may give himself up to momentary impulses and employ any number of themes in a free fantasia. The former, however, is a great art, and nearly all the masters, notably Bach and Beethoven, excelled in it. To improvise in a given form requires not only an unusual command over the technique, but also a marvelous power of concentration. Undoubtedly the improvisation of a strict fugue is the most difficult task imaginable. Bach was a master of this.

IMPULSE (from Lat. *impulsus*, incitement, from *impellere*, to incite, from *in*, in + *pellere*, to drive). The typical motive to voluntary action. (See ACTION.) Such action is, at first, unequivocally determined: that is to say, the bodily movement follows, without hesitation or reflection, upon the formation of single, unchallenged motive. As the physical organism and the mind grow in complexity, voluntary action comes to be equivocally conditioned; there is a period of deliberation and doubt, characterized by a conflict of motives, some one of which ultimately prevails, as actual motive, over the potential motives, its rivals.

The simplest form of voluntary action, that which is prompted unequivocally by one unquestioned motive, is termed in psychology impulsive action, and the motive itself an impulse. The scientific definition of the terms is reflected in popular usage: we call a character 'impulsive' which acts off-hand, without balancing of alternatives: though the ideas of waywardness and unaccountability that we associate with the idea of an 'impulsive character' do not attach to the impulse as such, but indicate rather some inherited idiosyncrasy or defect of early training. The impulse proves, on analysis, to be a fairly stable connection of sensational and affective processes. If we look at it in its complete or perfect form, but make its constituent processes as simple as possible, we find the following components: (1) the perception of an *object* to which we are attracted or from which we are repelled; (2) an idea of our own movement toward or away from the object, based upon previous experience of actual movements; (3) an idea of the result of our movement; and (4) an affective process, the resultant of the affective colorings—oftentimes mutually opposed—of the three sensory factors. It is not difficult, in laboratory practice, to arrange for the formation of a motive in which these latter processes shall be represented on practically equal terms. In real life, although (as we said) the impulse is fairly stable in composition, we usually find a predominance of some one of the three ideas, and a subordination of the others. Thus, the idea of our own movement may recede far into the background of the impulsive consciousness, where it finds expression, perhaps, only in some inconspicuous fringe of organic sensation; while, as the reach of consciousness increases, the idea of object comes more and more to be lost sight of in comparison with the idea of end or result. It should be remarked, further, that the idea of our own movement, important as it is at a certain level of mental development, cannot be contained in the very first impulse, and cannot be of much importance for a considerable time after voluntary movements have been initiated: for, on the one hand, we must have moved before we can have an idea of our movement (so that the most primitive action of all is an 'action upon presentation,' made in response to the simple perception of object); and, on the other, primitive movements are too vague, and too little differentiated, to play the regulating and refining part that they later assume. Conversely, the complex motives that enter into conflict with one another in volitional and selective action are simply complicated impulses, in which the place of perception and idea is taken by associations of ideas or by judgments or trains of reasoning.

It is difficult to give an illustration of an impulsive action, for the reason that what is impulsive in one man's consciousness need not be so in another's. The impulsive action which we select may have been repeated so often as to have degenerated into ideomotor action, or even into a secondary reflex; or it may be so unaccustomed as rather to deserve the name of selective or volitional action. We can, however, take a fictitious case. Suppose that a boating party, arriving at a secluded bay, are seized with the impulse to bathe. Here we have the object-perception of the cool, clear water; the anticipation in idea of the free movements of diving and swimming; and the further forecast of the bodily vigor and refreshment that will ensue. All three ideas are pleasant. An opposition of affective processes might arise if the water is distinctly cold: in this case, the combined pleasantness of movement and result overcome the unpleasantness of the object-perception. It is, however, easy to see that, for persons who always bathed when they had the opportunity, the action would be rather ideomotor than impulsive; whereas, by those members of the party who were weak swimmers, the plunge might be taken only after a good deal of hesitancy and indecision.

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IMPULSE OF A FORCE. See MECHANICS.

IMPUTATION (Lat. *imputatio*, from *imputare*, to ascribe, from *in*, in + *putare*, to think, from *putus*, clear; connected with Lat. *purus*, pure, Skt. *pū*, to purify). One of the common technical terms of Christian theology. It denotes the transference of the *merit*, in a legal sense, of punishment or reward.

The two problems in connection with which the term is used are those offered by the universal prevalence of sin in the world, and by the forgiveness of men, which the New Testament teaches is for Christ's sake. The former problem arose in connection with the Pelagian controversies in the time of Augustine (see PELAGIANISM; PELAGIUS; AUGUSTINE); the latter in connection with the controversies of the Reformation. The Scriptures teach *some* connection between Adam's sin and the sinfulness of all men (cf. Rom. v. 12). Augustine explained it by a theory of realism, that men sinned *in* Adam. Calvinism taught that Adam's sin was *imputed* to his posterity, so that they were treated *as if* they had committed it, being held to the consequences of it in the form of disorder of nature, and actual sin resulting therefrom. In the course of time several varieties of imputation were distinguished, immediate, mediate, etc. This phraseology was supposed to be derived from the scriptural usage, but no like use can be found in the Scriptures. Properly understood, it conveys erroneous ideas, and may be allowed as one of the standard forms of theological expression. But it has the disadvantage of being a purely external, forensic form of statement, and of neglecting the ethical elements of the doctrine. In respect to the forgiveness of sinners for Christ's sake, imputation was originally applied by the Church of the Reformation only to Christ's passive obedience, or suffering on the cross; and when this was said to be imputed to us, nothing more was meant than that we are forgiven for Christ's sake. Later, by that scholastic tendency which always dominates in the period of systemization, distinction was made between the passive and the active obedience of Christ or His obedience to the law, and this was also said to be imputed to the sinner in the act of justification. A new connotation was insensibly added to the word impute, and it was supposed that only that could be imputed to one which he did *not have*. Thus the Westminster Confession finally went so far as to say that faith itself is not imputed to believers as 'their righteousness,' although it is said in Rom. iv. 3 that Abraham's faith was imputed to him for righteousness. The distinction is correct if it be understood that faith is not imputed as the *ground* of their forgiveness, which ground is the work of Christ. This is the indubitable meaning of the Confession. But it is as certainly the meaning of the Epistle to the Romans that faith, since it involves complete and loving submission to God's will, is of the essence of righteousness.

Modern theology, even when of Calvinistic descent and in sympathy with the truths which Calvinism sought to formulate and defend, professes to emphasize the internal and ethical aspects of the doctrine. The connection of Adam and the race in the matter of sin, instead of being explained by realism and imputation, is explained by the law of heredity. If Adam sinned, it was inevitable that so serious and deep-reaching a fact should propagate itself. Like begets like; a web-footed bird, another web-footed one; a sinner, a sinner. The law of habit plus the law of heredity is all that is necessary to explain the universal corruption of human nature and the universality of sin. Forgiveness for Christ's sake, in like manner, can be better explained without than with the employment of the idea of imputation. Christ cannot, strictly speaking, *merit* anything for us, because merit, like demerit, is essentially personal, and cannot be transferred. But Christ can do that *on account of which* it is consistent with the nature and attributes of God, and with the honor of the law and of the divine justice, freely to forgive sin. He alone can do this. And therefore He alone can lay the ground of our forgiveness. His sufferings are, therefore, that on account of which we are forgiven; and this covers the whole subject without need of bringing in any imputation whatever. The difference is, however, more one of point of view and phraseology than of essential doctrine.

IMUS, ē'mōōs. A town of Luzon, Philippines, in the Province of Cavité, founded in 1795 (Map: Philippine Islands, E 5). It lies within a short distance of Manila Bay, and about 18 miles south of Cavité. Population, in 1898, 14,675.

INACHUS, ĭn'ȧ-kŭs (Lat., from Gk. Ἴναχος). The Greek name of a river in Argos, and also of the god of the river. When Poseidon disputed about the possession of Argos, and Inachus decided for Hera, Poseidon is said to have dried up the bed of the stream, so that no water could flow through it in summer. Inachus is described also as the first King of Argos, and leader of the Argives from the mountains to the plains, whence Argos is called Inachian. In the legends he is especially celebrated as the father of Io (q.v.).

INAGUA, ē-nä'gwȧ, GREAT and LITTLE. Two of the Bahama Islands, West Indies, situated at the southern end of the group (Map: West Indies, L 4). Great Inagua lies about 60 miles northeast of Cuba, and occupies an area of over 660 square miles. It is only slightly elevated, and is surrounded by reefs. The chief settlement is Matthew Town. Little Inagua lies about 10 miles northeast of the larger island, and has an area of about 36 square miles, and but few inhabitants. The population of Great Inagua is estimated at 1500.

INAJA PALM, ĭn-äj'ȧ (probably from the native name), *Maximiliana regia*. A South American palm, common in the countries near the Amazon. It has a massive stem 15 to 20 feet high; very long, drooping, pinnate leaves, which are sometimes more than 15 feet long, with leaflets in groups of three, four, or five at intervals along the midrib, from which they stand out in different directions; numerous spadices; large woody spathes; and densely clustered elongate fruit, with tough skin and soft pulp, and hard stony seed. The spathes are used by hunters to cook meat in, and with water in them they stand in the fire well enough for the purpose. They are also used as baskets, and as cradles by the Indians, who also eat the fruit, which is particularly attractive to monkeys and some kinds of birds. The leaves yield a serviceable fibre that is used by the natives in the manufacture of ropes, hats, etc.

INAMA-STERNEGG, ē-nä'mȧ-stĕr'nĕg, KARL THEODOR VON (1843—). An Austrian economist and statistician, born at Augsburg. Educated at Munich, he became docent there (1867), professor at Innsbruck (1868), and at Prague (1880). In the following year he was made head of the Statistical Bureau in Vienna, and professor of the University of Vienna. He was president of the Central Statistical Commission (1884), and in 1891 he was named a life member of the Austrian Upper House. An economist of the historical school, he was editor of the *Zeitschrift für Volkswirtschaft, Socialpolitik und Verwaltung* (1892), and of many departmental publications. He wrote: *Verwaltungslehre* (1870); *Die Ausbildung der grossen Grundherrschaften in Deutschland während der Karolingerzeit* (1878); *Deutsche Wirtschaftsgeschichte* (1879-1901); the important *Zur Verfassungsgeschichte der deutschen Salinen im Mittelalter* (1886); *Sallandsstudien* (1889); *Abriss der deutschen Wirtschaftsgeschichte* (in Paul's *Grundriss der germanischen Philologie*, 1889); and *Die persönlichen Verhältnisse der Wiener Armen* (1889).

INANITION. See STARVATION.

INARCHING. A method of grafting (q.v.).

INBREEDING. See CROSS-FERTILIZATION.

INCANDESCENT ELECTRIC LIGHT. See ELECTRIC LIGHTING.

INCANDESCENT GAS LIGHT. See GAS, ILLUMINATING.

INCANTATION (Lat. *incantatio*, from *incantare*, to enchant, from *in*, in + *cantare*, frequentative of *canere*, to sing). The employment of song for magical purposes. In consequence of the excitement awakened by rhythmical utterance, verse has from early times been supposed to possess a divine element. Vergil and Horace represent songs as able to bring down from heaven the moon and the stars; and such influence, in these poets only fanciful, was at an earlier period commonly ascribed to sacred verses. It was further believed that both gods and ghosts were placated by song; and it is a universal feature of worship that in all ceremonies chants are employed which have been handed down from antiquity, preserved with scrupulous exactitude, and supposed to exert supernatural effect. In ancient times every function of human life was accompanied with incantations, presumed to be as essential as were the natural means employed. Poetic formulæ, it was supposed, had power to summon and banish demons, to raise and disperse storms, to bestow sunshine and rain, to grant success in war and in love, to inflict and remove disease, to cause crops to grow, wither, or remove from one granary to another, to make cattle breed and bees swarm, to bring success to the fisherman and hunter, and so on indefinitely. Song, when used for magic ends, is often reënforced by appropriate motions and actions, and frequently recited by a shaman (medicine-man, magician). Thus, among Navahos the rite called the Mountain Chant, primarily intended for the cure of disease, constitutes an elaborate festival of nine days' duration. It is explained by a myth, to which the songs allude. These form sequences, of which the order must not be changed, and among them are prayers of a simple character, which recite the nature of the sickness, entreat that it may be healed, and end with an assertion that the work is accomplished. Similarly, ancient Babylonian formulæ of an exorcistic character, directed against diseases conceived as evil spirits, ordinarily begin with enumerating the effects of the malady or names of the hostile powers, express the desire of the suppliant for recovery, and conclude with an invocation to Heaven and Earth, who are besought to deliver the sufferer. These also were often associated with ritual, for the performance of which directions are given. Of course, with the songs are sometimes employed other agencies, as when in the *Odyssey* the hero, injured by a boar's tusk, has his hurt bound by the sons of Autolycus, who then proceed to employ an incantation, supposed to stanch the wound. In process of time the ceremonies employed in such cases fell into disuse, and the words of such charms became half intelligible, or altogether meaningless. It seems to have been always usual that the miraculous healer should recite his rhymes in a low tone of voice, in such a manner as to be unintelligible to spectators, whose sense of mystery was thereby heightened. Considering the tenacity of tradition, it might be expected that some of these formulæ should have a long history. For instance, a German incantation recorded in the tenth century, and evidently of heathen origin, relates that while certain deities were riding in the forest, a horse dislocated his leg, which the gods wished to heal; Woden was successful by means of an incantation. A similar charm at a later time appears in Christian form, Peter and John replacing the deities, and Christ taking the place of Woden as the healer. In the nineteenth century, a form of this incantation was still in use in Shetland, but accompanied by an elaborate ceremony, every part of which was regarded as essential, and which included the use of a thread spun from black wool and having nine knots, wound about the sprained part. At the present day the custom remains in force among simple peoples. In English nursery lore the habit of incantation survives in some simple rhymes of children and young people, as, for example, in verses directed against rain, or those addressed to the moon and stars in order to obtain auguries as to the future mate. Consult the authorities referred to under MAGIC.

INCARNATION (ML. *incarnatio*, from Lat. *incarnari*, to be made flesh, from *in*, in + *caro*, flesh, Gk. *κρέας*, *kreas*, AS. *hrāw*, Skt. *kravya*, raw flesh). In Christian theology, the assumption of humanity, by the second person of the divine Trinity, by which He was both God and man in one person. The idea of the manifestation of God in human form is as old as religion. It underlies all the supposed appearances of God to men. It is found especially in the religion of India, where there are repeated incarnations of the divine principle in beasts and men. (See METEMPSYCHOSIS.) The biblical doctrine is, however, entirely different from all these doctrines, since it is the doctrine of a real assumption of human nature, by a distinct person of the Trinity, for a specific purpose, and once only. It is as different from other doctrines of incarnation as the Christian doctrine of sin is from other doctrines.

The fact of the incarnation is variously represented and sustained in the Scriptures. It is introduced by the story of the miraculous conception of Jesus. He was not born, as other men are, of two parents, but was born of a virgin, miraculously conceived by her of the Holy Ghost. The direct evidence for this is confined to the two Gospels of Matthew and Luke. The disposition has been frequently manifested to deny the value of the accounts and the reality of the miraculous conception. This has recently received some furtherance from the higher criticism of the New Testament. The fact that the accounts are not confirmed from other sources of the Gospel history, that the genealogies seem to derive Jesus' descent from Joseph, that various expressions are used in the body of all the Gospels implying that He was born in the natural way, and that Paul and other New Testament writers know nothing of the matter, is variously urged. But there is nothing inconsistent with the accounts or the fact in other portions of the New Testament, and the peculiar nature of the subject demanded a degree of reticence upon it which would naturally lead to its late explanation, and to the silence of most of the New Testament, written when it was, upon this point. For an excellent discussion of the subject, consult Weiss, *Life of Christ*, book ii., ch. 11 (Eng. trans., Edinburgh, 1883).

By the miraculous conception God specially prepared the humanity of Jesus, and the natural conclusion is that it was prepared for a special purpose. Then, all through the Gospels Jesus is represented as having 'come' into the world. In the Gospel of John it is said that the Word, who "was in the beginning with God and was God," "became flesh" (John i. 14), or man, and in Philippians (ii. 6-7) it is similarly said that Christ, "being in the form of God," emptied Himself and took "the form of man." The whole atmosphere of the New Testament is that in Christ we have a heavenly, an eternal, a divine, being come to earth for the salvation of man. And that there may be no doubt that such is the real meaning of the Bible (intimated in the Old Testament as well as declared in the New), the later writers of the New Testament ascribe to Christ the work of creation, that of preservation, and that of divine government of the world, designate Him as the goal toward whose glorification the world is tending, and teach that He will come in glory to be our judge, to close the history of this world, and to deliver up the kingdom again to the Trinity.

Thus the reality of the divine nature of Christ is set forth. But another point must be understood before the biblical doctrine is fully comprehended. This heavenly being, come to earth of His own act for the salvation of man, is the proper 'self,' the dominating and willing 'I,' in the person of Christ. Thus Christ is not a man in whom God dwells, illuminating Him and fitting Him for the work of a prophet, but He is God Himself, acting variously for the instruction, enlightenment, and salvation of man.

At the same time, the human nature of Christ is real and entire. He was truly born, and lived as other men do. All this in perfect unity of consciousness, which was the consciousness of the divine Logos. The explanation of the union of these two natures in one person is the task of Christology (q.v.).

Consult: Gore, *Incarnation of the Son of God* (London, 1891); Ottley, *Doctrine of the Incarnation* (London, 1896); Simon, *Reconciliation by Incarnation* (Edinburgh, 1898); Dorner, *History of the Development of the Doctrine of the Person of Christ* (Eng. trans., Edinburgh, 1861-63); Eck, *The Incarnation* (London, 1902); Powell, *Principle of the Incarnation* (London, 1896); Orr, *Christian View of God and the World as Centring in the Incarnation* (Edinburgh, 1893); Dix, *The Sacramental System Considered as an Extension of the Incarnation* (London, 1893); Didon, *Vie de Jésu* (Paris, 1890; trans. *Jesus Christ*, New York, 1891); Touard, *The Christ the Son of God* (trans., London, 1890); G. F. Baur, *Die christliche Lehre von der Dreieinigkeit und Menschwerdung Gottes* (Tübingen, 1841); Thomasius, *Christi Person und Werk* (Erlangen, 1874); id., *Dogmengeschichte* (ib., 1874); Gess, *Christi Person und Werk* (Basel, 1870-87); Harnack, *Dogmengeschichte* (Freiburg, 1893). See CHRISTOLOGY.

IN′CAS. See PERUVIAN ARCHÆOLOGY.

INCE-IN-MAKERFIELD, ĭns′ĭn-măk′ẽr-fēld. A town in Lancashire, England, one mile east-southeast of Wigan (Map: England, D 3). It has railway-wagon works, iron-works, blast-furnaces, cotton-works, and extensive coal-mining. The town has owned its water-works since 1871. Population, in 1891, 19,250; in 1901, 21,270.

INCENDIARISM. See ARSON.

INCENDIO DEL BORGO, ĕn-chăn′dē-ō dĕl bôr′gō (It., burning of the city). A fresco by Raphael in the Vatican.

INCENSE (from OF., Fr. *encens*, Lat. *incensum*, incense, from *incendere*, to burn, from *in*, in + *candere*, to glow; connected with Gk. *καθαρός*, *katharos*, pure, Skt. *ścandra*, *candra*, shining, noon, from *ścand*, to be bright). A perfume the odor of which is evolved by burning. Its use in public worship prevailed in many ancient religions. The incense at present in use consists of some resinous base, such as gum olibanum, mingled with odoriferous gums, balsams, etc. There is no regular formula for it, almost every maker having his own peculiar recipe. The ingredients are usually olibanum, benzoin, styrax, and powdered cascarilla bark. These materials, well mingled, are so placed in the censer (q.v.) or thurible as to fall by sprinkling on hot charcoal, which immediately volatilizes them, and their odor is diffused through the edifice. Among the Jews the burning of incense was exclusively employed as an act of worship. In the Catholic Church, both of the West and of the East, incense is used in public worship, more particularly in connection with the eucharistic service, which is regarded as a sacrifice; but writers are not agreed as to the exact date at which such use was introduced. Saint Ambrose, in the Western Church (340-397), alludes to incense in terms which suppose the practice of burning it to be an established one; and in later writers it is mentioned familiarly as a part of ordinary public worship. It is used in the solemn (or high) mass, in the consecration of churches, in solemn consecrations of objects intended for use in public worship, and in the burial of the dead. In the reformed churches the use of incense was abandoned, but in the last half-century it has been restored to some extent in the Anglican communion; and the 'Catholic Apostolic' (or Irvingite) Church (q.v.) has used it since its foundation.

INCEST (OF., Fr. *inceste*, from Lat. *incestum*, incest, neut. sg. of *incestus*, unchaste, from *in-*, not + *castus*, chaste). Sexual intercourse between persons who are legally prohibited from marrying because of their affinity or consanguinity (q.v.). It is not a common-law offense, but in England is punishable in the ecclesiastical courts by excommunication and penance. It is said to be the only form of immorality which, in the case of the laity, is still punished by the ecclesiastical courts on the general ground of its sinfulness.

In most of the American States it is a criminal offense by statute, punishable by imprisonment for a term of years, usually not exceeding ten. In some States the marriage of persons within the prohibited degrees, even when not followed by cohabitation or accompanied by sexual intercourse, amounts to criminal incest. Consult: Stephen, *History of the Criminal Law of England* (London, 1883); Blackstone, *Commentaries;* Bishop, *Statutory Crimes* (Chicago, 1901).

INCH′BALD, Elizabeth Simpson (1753-1821). An English novelist and playwright, born at Stanningfield, near Bury Saint Edmund's, Suffolk. She educated herself, mostly by general reading. After vain attempts to engage herself as actress, both in Norfolk and in London, she married, in 1772, the actor Joseph Inchbald. Later in the same year she made her first appearance on the stage at Bristol in the rôle of Cordelia. With her husband she performed in the provincial towns till his death (1779), and continued to appear for ten years more. As an actress she had the advantage of great personal charm, but an impediment in speech prevented the highest success. Beginning to write for the stage as early as 1782, she produced about twenty comedies and farces, which were well received at the London theatres. But of her literary work, only her two novels have survived: *A Simple Story* (1791), which, though ill-constructed, was one of the best novels since the death of Smollett; and *Nature and Art* (1796), which was also very popular. Mrs. Inchbald also edited three collections of plays: *The British Theatre* (25 vols., 1806-09); *Modern Theatre* (10 vols., 1809); and *Farces* (7 vols., 1809). She wrote her memoirs, but destroyed them. Consult: Scott's edition of her *Novels* with a memoir (London, 1880); Boaden, *Memoir* (ib., 1833); Elwood, *Memoirs of the Literary Ladies of England* (ib., 1842).

INCH′CAPE ROCK, or Bell Rock. A dangerous reef in the North Sea, east of the Firth of Tay in Scotland. A bell attached to a buoy is said to have been placed here by an abbot of Aberbrothock to warn sailors. This bell was cut from its support by a pirate, who, on a subsequent voyage, was lost on the spot. The tradition is embodied in Southey's ballad "The Inchcape Rock." In 1810 a lighthouse was built with much difficulty on the reef.

INCH′COLM. A picturesque islet in the Firth of Forth, Scotland, separated from the Fife shore by 'Mortimer's Deep,' a channel about a mile wide (Map: Scotland, B 4). It is half a mile long, with a maximum width of one-third of a mile, and is noted for its monastic ruins, which exhibit traces of the twelfth-century Romanesque architecture, but are chiefly in the early pointed style of the thirteenth and fourteenth centuries. They consist of the remains of an abbey of Austin Canons regular, founded by Alexander I. in 1123, and include a vaulted oratory, and a chapter-house with groined roof and three elegant sedilia. The Latin names of the islet are *Æmona* and *Insula Sancti Columbæ*, the latter derived from Saint Colm or Columba (q.v.) of Iona, who dwelt here in the sixth century. As Saint Colm's Inch, it is mentioned in Shakespeare's *Macbeth*, act i., scene 2. The monastery was frequently sacked by the English during the fourteenth, fifteenth, and sixteenth centuries. Consult Simpson, *Æmona and the Islands of the Forth* (Edinburgh, 1861).

INCHKEITH, Inch′kēth. A small fortified island of historic interest in the Firth of Forth, Scotland, nearly midway between Leith and Kinghorn (Map: Scotland, B 4). It has a lighthouse 220 feet above high water, visible 21 miles.

INCHWORM, or Measuring Worm. See Geometrid Moth.

INCIDENT (from Lat. *incidere*, to fall upon, from *in*, in + *caderĕ*, to fall). In law, a right, privilege, or burden inseparably annexed to an estate or tenure of lands. Thus, rent reserved upon a lease for life or years is incident to the reversion, or estate of the landlord, and passes with the latter upon its assignment; and a right to distrain is incident to a rent charge and attends it into whosesoever hands it may come; and a court baron is incident to a manor (q.v.), which, indeed, cannot exist without such a court. In the same sense, the rights of inheritance and of free alienation are incidents of an estate in fee simple, and the right to take estovers (q.v.) is an incident of a tenancy for life or years, while dower and curtesy are among the incidents of estates of inheritance.

More specifically, the term incident is employed in English law to describe a certain class of obligations attaching to the several forms of feudal tenure. Viewed from the standpoint of the lord of whom the lands were held, these were certain legally defined rights which inured to him by virtue of his superior or paramount title. They were due, as a matter of legal obligation, from all land held by such tenure, and not by virtue of any understanding or agreement—which fact distinguishes them from the *services* due from the tenant to the lord, which were entirely a matter of agreement.

The most important of these 'feudal incidents,' as they are termed, were *aids, reliefs*, and *escheats*, which were due from all secular tenures, and *wardship* and *marriage*, which were peculiar to the military tenures. These will be described under their appropriate titles. Though differing greatly in the kind and amount of the burden which they imposed upon the land, they had this in common, that they came to be regarded as the essential and distinguishing characteristics of the several forms of tenure to which they were appropriate. The military structure of the feudal system in England decayed rapidly after the Conquest, and the expression military tenure, or tenure in chivalry, was regarded not as tenure for which military service was in fact to be rendered, but tenure attended by the burdensome incidents of wardship and marriage; while socage tenure was not so much a tenure by a fixed and determinate service, as one free from those incidents.

Most of the incidents of tenure were done away with by the famous statute which abolished military tenures (12 Chas. II., c. 14), and only the right of escheat remains to remind us of the feudal origin of our land law. See Feudalism; Socage; Tenure; and the authorities there referred to.

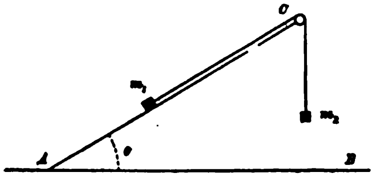
INCIDENTALS (from *incident*, from Lat. *incidere*, to fall in, from *in*, in + *cadere*, to fall).

In music, the notes of a chord which are not absolutely essential to its harmonic completeness. Incidentals are thus opposed to essentials (q.v.). They are divided into two classes, consonant or strong incidentals, and dissonant or weak incidentals.

INCLEDON, Iŋ'k'l-don, Charles Benjamin (1763-1826). An English singer, born at Saint Keverne, Cornwall. He received his musical education in the choir of the Exeter Cathedral, to which he was admitted in 1771. A few years afterwards he entered the navy, and served until 1783. His professional career as a musician began when he appeared at the Southampton Theatre in the *Castle of Andalusia.* In 1817 he visited America, and sang the rôle of Hawthorn in *Love in a Village,* at the Park Theatre, in New York City. Soon after his return to England he left the stage, and from that time traveled in the provinces as a musical entertainer. His voice was best adapted to ballads, and it was in this kind of singing that he excelled. Three songs which contributed greatly to his popularity were "The Storm," "Black-Eyed Susan," and "Arethusa."

INCLINATION, Magnetic, or Dip. The angle made with the horizontal by the axis of a magnetic needle swinging freely in a vertical plane. The inclination of a magnetic needle varies at different places of the earth's surface, ranging from 90° at the magnetic poles to zero at the magnetic equator. The varying amount of magnetic inclination will be found indicated on the isoclinic charts accompanying the article Magnetism, Terrestrial. This property of a magnetic needle was first discovered by Robert Norman in 1576, and an instrument was devised by him by which the amount could be measured. The phenomenon had previously been noticed by George Hartman, in Nuremberg, in 1544, but he was neither able to measure the amount of inclination accurately nor to explain the phenomenon. The amount of inclination is determined by the dipping needle (q.v.) and is measured when the magnetic needle is freely swinging in a vertical plane containing the meridian. If the plane of the needle is placed at right angles to the magnetic meridian, the axis needle will form an angle of 90° with the horizontal. The dip of the needle is subject to the same periodic variations as its declination (q.v.), but these changes play a far less important part. In order that an ordinary compass-needle may swing in a horizontal plane, it is customary in northern latitudes to make the southern end of the needle heavier; or the same effect may be secured by using a symmetrical needle which has been weighted with a small bit of brass on its southern half. See Compass; Declination; Dip of the Magnetic Needle; Dipping Needle; Magnetism; Magnetism, Terrestrial.

INCLINED PLANE. A smooth plane inclined to the horizontal plane at any point on the earth's surface. Imagine a plane section through this inclined plane and the horizontal one, perpendicular to their line of intersection. Let the plane be supported by an upright; and let two bodies of masses m_1 and m_2, joined by an inextensible string, be placed, as shown, one on the plane, and one hanging freely, the string passing over a pulley. If the bodies are in equilibrium, the forces on the body of mass m_1, parallel to the plane, must balance each other. There is a force $m_1g\sin\theta$ down the plane and a force m_2g up the plane; hence $m_1g\sin\theta = m_2g$; or, in general, the force up the plane equals the weight of the body on the plane multiplied by the sine of the angle of inclination of the plane. To produce motion up the plane of a heavy body requires, therefore, less force than its weight.



INCLINED PLANE.

The 'mechanical advantage' is $\frac{1}{\sin\theta}$

Another method for solving this problem is to consider as before the two bodies in equilibrium, and to produce a small displacement; let the body whose mass is m_1 move up the plane a distance x_1, and the body whose mass is m_2 move vertically down, owing to this, a distance x_2. By the principle of energy $m_1g\sin\theta\, x_1 = m_2gx_2$; but $x_1 = x_2$; hence, as before, $m_1g\sin\theta = m_2g$. Inclined planes are still used daily for rolling up heavy weights. They were used by all ancient peoples for raising heavy stones for building purposes. The screw is nothing but an inclined plane rolled around a cylinder.

INCLOSED ARC LAMP. See Electric Lighting.

INCLOSURES OF COMMONS. At common law, the only method by which the right to inclose lands subject to common rights could be gained was by mutual agreement between all who had commonable privileges therein. It was a tedious and unsatisfactory method. Oftentimes some of the interested persons were subject to disabilities, in which event a special act of Parliament was required. The benefits of inclosure became evident centuries ago, and as early as the reign of Henry III. a general act of Parliament, known as the Statute of Merton, was passed, authorizing the 'inclosure and approvement' of commons of pasture, upon certain conditions. In the reign of Edward I. the Statute of Westminster the Second was passed in amendment and extension of the former act. Comparatively little progress was made under the laws in the partition of common lands. Not until 1801 was a general inclosure act passed. This has been followed by a large amount of legislation, all tending in the direction of facilitating the division of commons, their conversion into separate and independent land holdings, the inclosure of such holdings, and the improvement of those portions that are retained for the common use of towns or villages. Consult: Williams, *Rights of Common* (London, 1880); Scrutton, *Commons and Common Fields* (London, 1887).

IN CŒ'NA DOM'INI (Lat., at the Supper of the Lord). A celebrated Papal bull, so called because designed to be read in the Church on every Holy Thursday, the day on which the Lord's Supper was instituted. It is not, as other bulls, the work of a single pope, but with various additions and modifications, dates back to early times; some tracing it to Urban V., and others to Martin V., Clement V., and some to Boniface VIII. Its present form, however, it received from the popes Julius II., Paul III., and finally Urban VIII., in 1627, after which it continued for a century and a half to be published annually. Pius V., in 1568, decreed that it should be read every Holy Thursday until superseded. The contents of this bull have been a fertile subject of controversy. It may be briefly described as a summary of ecclesiastical censures, especially of those with which grievous violation of the faith of the Church, or of the rights of the Church or of the Roman see, are visited; excommunication being denounced against heresy, schism, sacrilege, usurpation of the rights of the Church or of the Pope, forcible and unlawful seizure of Church property, personal violence against ecclesiastics, unlawful interruption of the free intercourse of the faithful with Rome, etc. The bull, however, although mainly dealing with offenses against the Church, also denounced under similar censures other crimes, as piracy, plunder of shipwrecked goods, forgery, etc. This bull, being regarded by most of the sovereigns of Europe as an infringement of their rights, encountered in the seventeenth century the determined opposition of nearly all the courts, even the most Catholic; and at length, in 1770, Clement XIV. discontinued its publication, which has never since been renewed. Pius IX., on October 12, 1869, abrogated many of its censures.

INCOMBUSTIBLE FABRICS. Much attention has been paid to the production of incombustible fabrics, and of solutions which may be applied to any fabrics to render them more or less fireproof. As typical of the first may be mentioned asbestos cloth when this fibre is used either wholly or in part to form the fabric. Experiments have shown that many salts possess this power of rendering substances which were immersed in solution of them incombustible, but at the same time some of these injure the fabric, spoil the color, or are so very expensive as to render their general use impossible. Two, however, viz. tungstate of soda and sulphate of ammonia, produce the best results without injuring the tissue or color of the fabric. The first of these acts physically by preventing contact with the air, and does not interfere with the process of ironing and starching; it is, therefore, preferable for goods requiring washing. For fabrics which are used without previous washing, sulphate of ammonia is preferable. Soluble glass is a highly alkaline solution of minerals composing glass which is applied to textures, in theatres especially for curtains and scenery, to render them fireproof. Fire touching them melts the invisible minerals into a glaze which excludes air and prevents combustion. All these solutions, however, are likely to lose their efficiency if some time has elapsed since they were applied. See FIREPROOFING.

INCOME TAX. A tax upon the income of individuals. It may be levied directly upon the individuals receiving the income, or it may be collected from the income at its source in the form of a tax upon dividends, interest on bonds, etc. It may be uniform, taxing all incomes at a uniform rate, or progressive, increasing the rate of taxation with the amount of income received by the individual. An income tax may differentiate between various forms of income, as, for example, between incomes from labor and incomes from property, or between permanent and temporary incomes. Differentiation may be attained either by levying a higher rate upon some forms of income than upon others, or by the imposition of a supplementary tax upon property or upon consumption which will in effect fall upon the incomes discriminated against.

In States which levy an income tax it is usually the practice to exempt small incomes, or that portion of the income necessary to mere independent existence or to the maintenance of the usual standard of life, and to levy the tax only upon the excess. The theory of such exemption is that the State should not take from the individual in the form of taxes what it will be obliged to return to him in the form of poor relief or otherwise.

In theory the income tax, more nearly than any other system, meets the requirements laid down in the most advanced canons of taxation. A man should be taxed according to his ability, or 'faculty'; and income is the best test of ability. A graduated tax on incomes is popularly defended on the ground that it may be employed to bring about a more equal distribution of wealth. In the latest financial theory, however, graduated taxation is justified on the ground that a man's ability to pay taxes increases more rapidly than his income. Differentiation of taxation is advocated on similar grounds. One who receives an income from permanent property is in a more favorable position than one who receives an equal income from labor, since the latter is compelled to make provision against unemployment, while the income of the former is quite at his disposal. It is, therefore, in accordance with the faculty test that incomes from property should pay a higher rate than incomes from labor.

In practice it is found to be difficult to determine directly the magnitude of a man's income. This is especially true in countries like America and England, where it is the policy of Government to interfere as little as possible in the business affairs of the individual. This difficulty is greatly reduced when the tax is levied, not directly upon the individual, but upon the source of the income. Under this system, corporations may be required to withhold a part of the dividends for the payment of the tax as well as a part of the salary of employees. When the tax is levied at the source, however, it is difficult to graduate it so as to tax those who receive large incomes at a higher rate than those whose incomes are small.

The income tax was introduced in England as a purely fiscal expedient. The huge expenditure of the Napoleonic wars forced the adoption in 1799 of an income tax, which, with a short intermission, lasted till the close of the war. It was again revived in 1842, and although in 1874 an attempt was made by Gladstone to secure the repeal of the tax, it has maintained its position to this day as an integral part of the British financial structure. The British income tax is levied on the source of the income, and does not attempt to provide for graduation or differentiation. It has proved to be a very productive tax; and by changing the rate the Government is enabled to increase or diminish its revenue so as to cover exactly fiscal needs. In Italy the income tax was introduced by the law of 1864 (amended in 1877), and the fiscal needs of France after the Franco-Prussian War forced it also to adopt a national tax upon the income of corporations and associations. By a law of 1891 Prussia introduced a direct tax upon incomes. The tax was graduated, but at first made no provision for differentiation. In 1893 an auxiliary tax was levied upon property, thus establishing differentiation in effect. In 1893 Holland adopted an income-tax law which provided both for graduation and differentiation. By this law corporations as well as individuals are subject to the tax; but the holders of corporate securities pay no additional income tax on the revenue from them. A similar law was introduced in New Zealand in 1893. Switzerland, Denmark, and Austria levy income taxes, as does also Australia.

During the War of 1812 an income tax was advocated for the Federal Government by Secretary Dallas, and in 1862 such a tax was actually adopted, and remained in force until 1872, despite the opposition of the propertied classes. No satisfactory machinery was established for its application. Individuals were required to submit estimates of their incomes, and as there was no means of verifying these estimates, the tax was paid only by those who were scrupulous enough to admit that their incomes exceeded the untaxed minimum. In spite of the great increase in national wealth, the receipts from the income tax declined from year to year. In 1894 the income tax was again introduced as a part of the Wilson Tariff Bill, and was carried largely by the Western and Southern members, despite violent opposition from the cities of the East. The tax, however, was declared unconstitutional (May 20, 1894) because, although a direct tax, it was not apportioned among the States according to population.

Income taxes have been imposed in several States (Massachusetts, Pennsylvania, Louisiana, Virginia, North Carolina, South Carolina), but in no case have they been rigidly enforced and justly administered, and in no case have they been productive of large revenue. The Income Law of Massachusetts dates from colonial times, and exempts incomes under $2000, as well as income derived from property already taxed. See Finance; Taxation.

INCOMMENSURABLE. See Commensurable.

INCONNU, ăɴ'kô'nų' (Fr., unknown). A fish, usually called the Mackenzie River salmon (*Stenodus Mackenzii*), which is intermediate between salmon and whitefish, usually weighs ten pounds, though sometimes it is much larger. It ascends all the rivers of Arctic America and Asia, and is of much importance to the natives of their valleys, though the fish is oily. It was discovered by Alexander Mackenzie, whose followers named it.

INCONSTANT, The; or, The Way to Win Him. A comedy by George Farquhar (1702), adapted from Fletcher's *Wild Goose Chase*.

INCORPORATED SOCIETY OF AUTHORS, The. A society organized in London, in 1884, by Sir Walter Besant, for the protection of authors and composers, and modeled on *La Société des Gens de Lettres* of Paris. Its purpose is to maintain the rights of authors, to advise them as to questions of copyright, to assist them in making contracts with publishers, and in recovering money due under contracts. The society has also vigorously advocated amendments to the copyright law, and in 1899 sent its secretary, Mr. G. Herbert Thring, to Canada to bring about a settlement of the colonial copyright question. The official organ is the *Author*, which is published monthly from the society's office. Among its other publications are: *Grievances of Authors; Literature and the Pension List; Copyright Law Reform; The Methods of Publication.* The first president of the society was Lord Tennyson.

INCORPORATION. The act by which a corporation is formed; also, the body or legal person so formed, which is more usually called a *corporation.* This act consists in the incorporators (or persons of whom the corporation is initially to consist) fulfilling the conditions which are imposed by law as a condition precedent to the formation of the corporation, which may consist in accepting a charter (q.v.), or in complying with the conditions of enabling statutes, or, for some purposes, the performance of acts as if the persons constituted a corporation (a corporation *de facto*). The effect of the act of incorporation is to create the rights and liabilities which the law attaches to the form of corporation so created, so that future acts relating to the corporate body may affect that as legal entity instead of the individual by whom the corporation is represented. For a treatment of the various classes of corporations and the specific acts necessary to their creation, see Corporation; Charter; also consult the authorities there referred to.

INCORPOREAL (from Lat. *incorporeus*, bodiless, from *in-*, not + *corporeus*, bodily, from *corpus*, body). In the common-law classification of real property, that which is not accompanied by seisin or the right of possession. Present estates in land, such as freeholds and leaseholds in possession, are identified with the land itself, and are described as *corporeal;* that is, as something substantial and tangible; while corresponding interests not in possession, such as future estates and rights in the land of others, are regarded as being of an unsubstantial and intangible nature, and are accordingly described as *incorporeal.* The distinction has no scientific value, as the idea connoted by the terms 'property' and 'ownership' is always that of a legal right, and rights are always bodiless things, and are equally immaterial and unsubstantial, whether they relate to present or future enjoyment of land, and, indeed, whether they have to do with things or persons. But the distinction is a convenient one, nevertheless, and has had an important influence on the development of property law.

In our legal system the classification of property as corporeal and incorporeal is confined to interests in land. Though future interests in chattels and such property as shares of stock, patent rights, and copyrights are sometimes described as incorporeal, and though such eminent legal authorities as Sir Matthew Hale and Blackstone apply the term corporeal to jewels and other personal chattels, the distinction is of no value or importance in the law of personal property. On the other hand, the usual limitation of the terms corporeal and incorporeal to hereditaments, i.e. to such interests as descend to the heir of the owner upon his death, is too narrow, as a future leasehold estate, or a profit *à prendre* (q.v.) for a term of years, which pass like other personal property to the executor or administrator, are equally entitled to be described as incorporeal.

It was in the methods of conveyance employed in creating or transferring the two kinds of property that the distinction between them attained its principal importance. Corporeal interests being susceptible of seisin, of possession, were said to 'lie in livery,' i.e. to be capable of transfer by the method of livery of seisin, or delivery of possession; whereas the more intangible incorporeal property, not being susceptible of physical transfer, was said to 'lie in grant,' i.e. to be transferable only by the form of deed known as a grant (q.v.). With the abolition of conveyance by livery of seisin and the general adoption of the method of conveyance by deed for all kinds of property, corporeal and incorporeal, the distinction has largely lost its importance. See HEREDITAMENT; REAL PROPERTY.

INCREMENT, THE UNEARNED. See UNEARNED INCREMENT.

INCROYABLES, ăn'kwrä'yȧ'bl' (Fr. word, meaning incredibles). A name applied to the Parisian dandies under the Directory, who made themselves conspicuous by their extravagance in dress, manner, and speech. One of their peculiarities was the omission of *r* in speaking, and they got their name from their favorite expression, *Ma petite pa'ole d'honneu', c'est inc'oyable* (me wohd of honnah, it's incwedible). They were mostly royalists. The type has been known at different periods in the history of France, by various names: *Agréables, Gommeux, Merveilleux, Mirliflors, Lions, Muscadins, Muguets, Petit-maîtres*, etc. (See JEUNESSE DORÉE.) The term 'Incroyables' is also applied to the exaggerated style of hats which they wore.

INCUBATOR (Lat. *incubator*, one who lies in a place, from *incubare*, to lie within, to incubate, from *in*, in + *cubare*, to lie). A term applied in poultry-raising to devices used for artificial incubation or the hatching of eggs. Artificial incubation was successfully practiced in very ancient times in Egypt and China, and probably other countries. The methods and appliances still used in China are quite simple, and even crude, but are employed with great skill and success. Réaumur, the eminent French physicist, used successfully a very crude form of incubator, consisting of a barrel heated with fermenting manure; but he encountered much criticism and opposition on the ground that chickens so hatched "were unfit for human food because they tasted of the heating material, and that such chickens were absolutely sterile, and if the process were persisted in the race of fowls would necessarily die out." Similar prejudice against incubator chicks has persisted until within comparatively recent years; but artificial incubation has become so firmly established, and, the experimental stages having long been passed, the methods and appliances have been made so simple and practical, that it is considered absolutely necessary in the rearing of fowls in large numbers. There were, of course, many failures in the early attempts to devise a practical incubator, although in the first application for a patent on such a device in this country, in 1847, some of the principles on which incubators should be constructed were stated with remarkable clearness and accuracy. Practical success with modern incubators may be said to date from the Paris Exposition of 1877, at which Rouillier and Arnoult exhibited their 'hydro-incubator.' "This incubator," says Beale, "has a very large tank, holding about fourteen gallons of water, which is divided into three horizontal compartments, each communicating with the others by means of a few small holes. This tank is placed in a wooden case, and surrounded on all sides save the bottom (under which is the egg-drawer) by an inch or more of felt, or some other non-conducting material, tightly pressed down. When this tank is filled with hot water, it is found that the water loses only from two to five degrees every twenty-four hours, according to the temperature of the place where it is kept. If the water in the top compartment only be drawn off, and that in the lower ones be left undisturbed, the former being again filled with boiling water, the heat from this will gradually affect the [temperature of the] lower body, and prevent its going down. By repeating this every twelve hours, the heat in the egg-drawer can be maintained at almost any degree of temperature, with a scarcely perceptible variation." Notwithstanding the simplicity and efficiency of incubators of this type, attempts to devise a practical automatic, self-regulating incubator were persisted in until incubators of this kind have been brought to a high state of perfection, and have been generally adopted. Incubators of the automatic type are of two main classes—hot-water and hot-air. The advantages and disadvantages of the better makes of the two classes are very

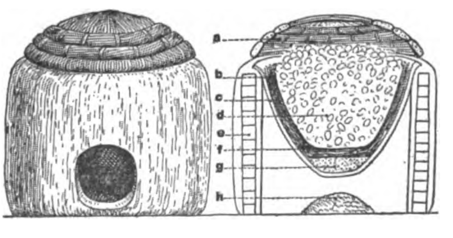


FIG. 1. CHINESE INCUBATOR.
a, cover; *b*, basket; *c*, jar; *d*, eggs; *f*, mat; *g*, ashes; *h*, charcoal.

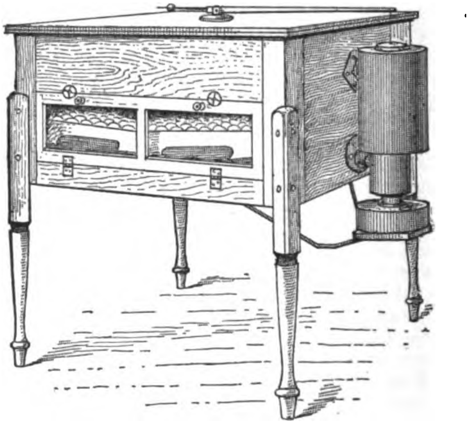


FIG. 2. MODERN INCUBATOR.

evenly balanced. There are hundreds of different makes of incubators on the market, many of them very efficient when properly handled. An average hatch of over 80 per cent. of fertile eggs is secured by experienced poultrymen, but experience, skill, and careful attention to details are essential to such success.

The essentials of a good incubator are an egg-chamber uniformly heated, preferably from above; a self-regulating source of heat, controlled by a thermo-regulator, the actuating arm of which is situated in the egg-chamber, and which is sensitive to 1°, or preferably ½°, above or below the desired temperature; and provisions for the ventilation of the egg-chamber, and for maintaining the proper degree of humidity therein. In addition to these, says Watson, "a convenient appliance for turning the eggs, positive in action, should accompany each incubator. This may be an extra tray that is to be placed bottom side up over the tray of eggs and held firmly in this position while both trays are turned, thus completely transferring the eggs from one tray to another without jar. The different machines have very different appliances for accomplishing this result." The object sought in artificial incubation is to imitate as closely as possible the conditions of heat, air, moisture, etc., which obtain in natural incubation under the hen. The temperature is carefully maintained at about 100° F. or only a few degrees above by placing the incubator in a basement, cellar, or other room where the temperature is stable, and by using a sensitive thermo-regulator to control the heat applied; the moisture of the air in the egg-chamber is carefully controlled, so that evaporation from the eggs proceeds as under normal conditions; and a sufficient amount of fresh air is supplied to the chamber to carry off the harmful gases which may accumulate and kill the incubating chick. The frequent turning of the eggs during the earlier stages of incubation is believed to have an analogy in the practice of the hen. However, it is not considered advisable to disturb the eggs after the eighteenth day, or to open the incubator thereafter until the hatch is complete, and the chicks dry. As the success of incubation depends so largely upon maintaining the proper moisture conditions in the air of the egg-chamber, some reliable means of controlling these conditions is essential. It has been proposed to use the normal loss of weight of eggs during incubation under brooding hens as a guide for this purpose. The West Virginia Agricultural Experiment Station found that the eggs which hatched under hens lost on an average 16.5 per cent. of their weight in nineteen days. The infertile eggs and those which did not hatch lost from 1 to 2 per cent. less. The normal loss of weight of 100 eggs under natural incubation was found to be about 10 ounces in 6 days, 20 ounces in 12 days, and 31 ounces in 18 days. By weighing the eggs in the tray at the beginning of incubation, and at intervals during the process, the progress of evaporation (loss of weight) may be determined, and the ventilation and humidity so controlled as to make the loss of weight conform to the normal figures. Except in very dry climates there is said to be more danger of over-saturation than under-saturation of the air. A humidity of 45 per cent. saturation is considered safe, as a rule.

If artificial incubation is practiced, some provision must be made for the care of the chicks when they leave the incubator. Variously artificially heated devices known as brooders are used for this purpose. These may be very simple and cheap, or elaborate and expensive. Almost all manufacturers of incubators also make brooders, and there is consequently a great variety of forms to choose from. The requisites of a good brooder are that it should be: (1) Warm (90°-100° during the first week, with gradually lowering temperature thereafter), and economical of heat, which is preferably applied mainly from the sides or above; (2) clean, dry, and well-ventilated; (3) simple in construction, and so arranged that the chicks may be seen. The brooder should be so constructed that the chicks may go out for exercise, and return at will.

BIBLIOGRAPHY. The literature of the subject is voluminous. All up-to-date treatises on poultry-raising explain the processes of artificial incubation, and describe methods and appliances. Among the books which may be consulted are: Watson, *Farm Poultry* (New York, 1901); Beale, *Profitable Poultry Keeping* (New York, 1895); Stoddard, *The New Egg Farm* (New York, 1900); Cyphers, *Incubation and Its Natural Laws* (Boston, 1894); *Incubators and Chicken-Raising Appliances* (London, 1899); Fiske, *Poultry Appliances and Handicraft* (New York, 1902). See FOWL.

INCUBUS (Lat., nightmare). (1) A sprite or demon, thought to have been the cause of nightmare. In the Middle Ages it was very commonly believed that the incubus had carnal knowledge of women while asleep, and that from this connection deformed children sprang. The *succuba* was the corresponding female sprite, supposed to consort with sleeping men. (2) Metaphorically, a burden upon mind or spirit. (3) A genus of parasitic hymenopters of the family Braconidæ.

INCUMBRANCE (OF. *encombrance*, from *encombrer*, to incumber, from *en*, in + *combrer*, to cumber, from *combre*, obstruction, from Lat. *cumulus*, heap). A generic term including every kind of charge or burden upon land; every right to or interest in land which may be held by a third person in diminution of its value, but not preventing the passing of the fee from a grantor to a grantee. The most frequent examples are afforded by *judgments*, *leases*, *mechanics' liens*, *mortgages*, *easements*, and similar burdens.

A covenant against incumbrances is one of the usual 'covenants for title' contained in a conveyance of land. As usually construed it amounts to a contract of indemnity, securing the grantee against loss by reason of any incumbrance which may exist upon the land at the time of the conveyance. See COVENANT.

IN'CUNAB'ULA (Lat., cradles). A name applied to printed books published before 1500. Specimens of such works are generally rare, and sought after for their historical bearing on the art of printing, and, as in first editions of Greek and Latin classics, for their scientific value. The number of incunabula is variously estimated, but is probably upward of 20,000. Among the works on the subject are: Hain's *Repertorium Bibliographicum* (Stuttgart, 1828-38) and Bernard, *De l'origine et des débuts de l'imprimerie en Europe* (Paris, 1853), besides a number of later treatises.

IND. A poetical form of India.

INDEB'ITA'TUS ASSUMP'SIT. See ASSUMPSIT.

INDEMNITY (from Fr. *indemnité*, from Lat. *indemnitas*, security from loss or damage, from *indemnis*, unhurt, from *in-*, not + *damnum*, loss). An engagement, either express or implied, to make good a loss or expenditure. It is not a guaranty within the fourth section of the Statute of Frauds (q.v.), which requires a special promise to answer for the debt or default of another to be in writing. When the indemnitor performs his engagement he may in so doing pay the debt of another, but the discharge of such debt is not what he promises to do; it is a mere accident of the situation. At times the engagement takes the form of a bond or other writing; but more frequently it is implied from the acts of the parties. Whenever a person asks another to become surety for him, the law implies the promise by the principal debtor to indemnify the surety for any loss that he may sustain by acceding to the request. So if two or more persons become co-sureties, there is an implied engagement on the part of each to indemnify the other to the extent of his share of the common loss. Fire and marine insurance policies are contracts of indemnity, the obligation of the insurer being not to pay the amount of the policy in any event, but only to save the insured harmless from loss in the event insured against. See INSURANCE. Consult the authorities referred to under GUARANTY.

INDENTED (from *indent*, OF., Fr. *endenter*, It., ML. *indentare*, to notch, from Lat. *in*, in + *dens*, tooth). In heraldry, one of the partition lines of the shield notched similarly to dancetté (q.v.), but with the notches much smaller, and not limited in number. See HERALDRY.

INDENTURE. See DEED.

INDEPENDENCE. A city and the county-seat of Buchanan County, Iowa, 69 miles west of Dubuque; on the Wapsipinicon River, and on the Illinois Central and the Rock Island railroads (Map: Iowa, F 2). It is in a farming and dairying region, and is noted for its horse-breeding farms. There are here the well-known Rush Park, with its kite-shaped race-track, the State Insane Hospital for Northern Iowa, and a public library. The water-works and electric-light plant are owned by the city. Population, in 1890, 3163; in 1900, 3656.

INDEPENDENCE. A city and the county-seat of Montgomery County, Kan., 85 miles southwest of Fort Scott; on the Verdigris River, and on the Missouri Pacific and the Atchison, Topeka and Santa Fé railroads (Map: Kansas, G 4). It has a public library and a fine court-house. The city is of considerable importance as a distributing point for an agricultural region, and has flour-mills, planing-mills, cracker-factories, cotton-mills, paper-mills, sugar-mills, a window-glass factory, vitrified-brick works, and a creamery. Natural-gas and oil wells are numerous in the vicinity. Population, in 1890, 3127; in 1900, 4851.

INDEPENDENCE. A city and the county-seat of Jackson County, Mo., five miles east of Kansas City; on the Chicago and Alton, the Missouri Pacific, and the Kansas City and Independence Air Line railroads (Map: Missouri, B 2). It is rapidly developing into a residential suburb of Kansas City. The Kansas City Ladies' College and Saint Mary's Academy are private schools situated here, and there is a public library. The industrial establishments include a large flouring-mill, a planing-mill, a canning factory, and scale-works. Independence was settled and incorporated in 1827, and was organized as a third-class city in 1889, the charter of that year still being in operation, and providing for a mayor, elected biennially, and a unicameral council. The electric-light plant is owned by the city. Population, in 1890, 6380; in 1900, 6974. Independence was occupied in 1831-38 by the Mormons, who regard the city as the 'Zion' where the chief Mormon temple will be ultimately erected on the famous 'Temple lot.' About 2000 members of the Reorganized Church of Jesus Christ of Latter-Day Saints, which disclaims belief in polygamy, now live in this vicinity. In 1849-50 Independence was a rendezvous and a starting-point for emigrants to California, two of the great trails leading from here westward. In the summer of 1862, during the Civil War, a Federal garrison of 312 under Lieutenant-Colonel Buel was captured here by a superior Confederate force under Colonel Hughes, and here on October 22, 1864, General Pleasanton attacked and defeated the rear of General Price's Confederate Army.

INDEPENDENCE, DECLARATION OF. See DECLARATION OF INDEPENDENCE.

INDEPENDENCE DAY. July Fourth, the United States national holiday.

INDEPENDENCE HALL. An unpretentious brick building in Chestnut Street, Philadelphia, erected in 1729-34, and intimately connected with the birth of the nation. In it the Continental Congress met, Washington was made commander-in-chief of the American Army in 1775, and the Declaration of Independence was adopted on July 4, 1776, and read to the people assembled in the street. It is now a museum of Revolutionary and historical relics.

INDEPENDENT CATHOLIC CHURCH IN THE UNITED STATES, THE (POLISH). An independent Church organized among the Polish immigrants in Chicago, with the hope of staying the progress of agnosticism among citizens of Polish descent who had become disaffected toward the Roman Catholic Church. Its founder, the Rev. Anthony Kozlowski, attended one of the Old Catholic conferences in Europe, and was there consecrated a bishop. A steady growth is affirmed of the Church, both in the consciousness of actual reformatory tendencies, and in numbers of adherents and strength of organization. It has established a hospital, a dispensary, an orphanage, and a Home for the Aged in Chicago, and has acquired a considerable property; primary, a grammar, high, and industrial schools have been established, with a college enterprise under way. All these schemes are connected, and form integral parts of a central philanthropic institution, called Saint Anthony's Home. In October, 1902, Bishop Kozlowski addressed a letter to the House of Bishops of the Protestant Episcopal Church in the United States asking for intercommunion. The subject was referred to a committee for consideration. The estimates of members in the Church vary. A careful computation gives it 33 ministers, 43 churches, and 42,850 communicants.

INDEPENDENT METHODIST CHURCH. See METHODISM.

INDEPENDENTS. Such bodies of Christians as claim the right of each individual church to administer its own affairs, free from ecclesiastical or civil authority. In history the name has been usually applied to the Congregationalists of Great Britain, who differ from the Congregationalists of America and other countries in regarding the fellowship of the local churches as unessential. The first Independent Church was organized in London about 1555, and the Brownists (q.v.), or Separatists, as the Independents were first called, steadily increased in numbers, in spite of persecutions and emigration. They were prominent in the Westminster Assembly. See CONGREGATIONALISM.

INDEPENDENT TREASURY. The name given to the system of keeping and disbursing the public money without the intermediary action of banks, State or national, adopted by the United States in 1846. The act of August 6, 1846, provided, in brief, that the public revenues should be held, until actually paid out, in the vaults of the Treasury at Washington or in the several subtreasuries in the larger cities created by the act. Prior to this date the Government receipts had been deposited in banks. The first Bank of the United States (see BANK, BANKING) was established in 1791, largely with the view of facilitating the fiscal operations of the Government. In it or its branches were deposited the Government funds, and from it were obtained temporary loans in anticipation of the revenue. When the bank charter expired, in 1811, the Government funds were deposited in the State banks throughout the country. With the subsequent suspension of specie payments, in 1814, the Government not only suffered with other creditors, but was seriously embarrassed by the fact that there was no standard national currency. In 1816 the second bank of the United States was chartered for a period of twenty years, and for the greater part of its existence it acted as the fiscal agent of the Government. Its effort, beginning in 1829, to obtain a renewal of its charter, led to a violent political contest, in which the opponents of the bank, led by President Jackson, won the victory. Though the charter did not expire until 1836, the President in 1833 ordered that no further deposits of Government funds be made in the bank, and that the funds of the Government be gradually withdrawn. This order for the 'removal of the deposits' was made on the alleged ground that the bank was unsound and that the public money was in danger.

Beginning October, 1833, the Government funds were deposited in State banks. Contracts were entered into between the Secretary of the Treasury and the several banks fixing the conditions upon which deposits were to be received. The refusal to recharter the Bank of the United States, together with the deposit of Government funds in the State banks, led to an ominous expansion of these institutions. A speculative era, marked especially by enormous sales of public lands, and the deposit or distribution of the Government surplus with the States (1837), now set in, which culminated in the panic of 1837. The Government funds were tied up in the non-specie-paying banks, and Congress was called together in September, 1837, to devise measures of relief. President Van Buren favored a complete separation of the Government from the banks, the establishment of an independent treasury, and a requirement that all debts due the Government be paid in specie. It was the latter provision which caused the defeat of the measure, as it appeared to the friends of the banks as a discrimination against the bank-note. Toward the close of Van Buren's Administration (June 30, 1840) the measure for which the President had fought valiantly was enacted into law, but not without the concession that in the first year of its operation only one-fourth of the Government receipts need be in specie, a further fourth being added each year until the whole should be so payable. The victory was dearly bought, for the party went down to defeat at the polls in November. The new Administration promptly repealed the law (August 13, 1841); but in the fruitless controversy with President Tyler over the Bank Law failed to provide any substitute for it. Public officials were left to their own devices in the custody of the public funds, and it was not until a new political revolution had occurred that the independent treasury system was finally established by the act of August 6, 1846.

The spirit of the measure was an absolute divorce of the Treasury from the banks. The Government was henceforth to keep its own funds, and to recognize only money issued by Federal authority, specie and Treasury notes, in the Government operations. The vaults and safes provided for keeping the money of the Government at Washington, and at such other places of deposit as were fixed by the law, were declared to constitute the Treasury of the United States. The Treasurer of the United States and assistant treasurers, and all other officials, were required to keep safely, without lending, using, depositing in banks, or exchanging for other funds, except as allowed by the act, all public money received by them or otherwise in their custody, until the same was ordered by proper authority to be transferred or paid out. In the early experience of the system some embarrassment was created by the failure to provide at once the necessary protection for the money in all the places where it was kept. But in general the system has worked well, and loss by theft or defalcation has been slight compared to the loss suffered through dealings with unsound banks in earlier years.

The isolation of the Treasury contemplated by the act soon proved illusory, and little by little inroads have been made upon the principle. The spectacle of the Treasury coming to the 'relief of the money market' has become familiar. The 'relief' thus afforded consists of placing in circulation money which the law accumulates in the hands of the Government. Operating with a surplus of revenue over expenditure, the Government balances may and do grow to such a size as to materially affect the volume of money in circulation. This, then, is a Treasury reserve which may be unloosed when a stringency in the money market occurs, and the fact that the Secretary of the Treasury is called upon for such relief is evidence of the futility of attempting utterly to separate the Government's operations from all business affairs. The independent Treasury was not ten years old before the possible dangers of an accumulation of funds were perceived, and in 1853 large redemptions of bonds were made to avoid them. In the panic of 1857 the Government escaped unscathed, and this added to the popularity of the independent treasury system.

But with the fiscal necessities of the Civil War the principle of isolation was broken down. The banks became essential to the support of the Government. The Secretary of the Treasury secured their aid in making the first loans of the war. He would not recognize their notes in the Government operations, but soon brought forward his plans for transforming the banks into national institutions under Federal control, with power to issue notes of a kind which could be recognized by the Government. When the national banking system was organized, in 1863, the banks were allowed to become depositories of the public money, except the receipts from customs, under regulations established by the Treasury Department. Customs receipts, being in specie, were excluded from the funds capable of being deposited, since banks were not then paying specie. These deposits in the banks are secured by bonds deposited with the Treasury Department. The extent to which the banks have been used as places of deposit has varied with the state of the Treasury and the nature of its operations. When loans have been made the money has been paid in through banks and allowed to remain there until expended. In the refunding operations of 1879 the banks sold nearly $400,000,000 worth of bonds, and held at one time (May, 1879) as much as $279,544,645. On the other hand, when the surplus has dwindled the amount of money so deposited has decreased, while in periods of an abundant surplus it has swollen in size. On October 1, 1902, the amount so deposited in banks was $126,102,430.

The idea of the Independent Treasury Law was that the banks should not interfere with the Treasury, while in its practical administration, with the enormous growth of Government revenue, the problem has been for the Treasury so to conduct its operations that it shall interfere as little as possible with the banks and the ordinary course of business. In principle the Government pays cash, demands cash, and keeps its funds in a strong box—a method of conducting business entirely at variance with the usual practice in mercantile life. The income and outgo of the Government have not, moreover, the regularity which frequently characterizes mercantile affairs. Money accumulating in the Treasury in anticipation of future payments is withdrawn from circulation. Such withdrawal may accentuate a stringency, while the subsequent payment may aggravate a plethora. As an offset to these disadvantages of the system, it has been contended that it equalizes conditions by permitting the Secretary of the Treasury to come to the 'relief' of the money market. This is a questionable advantage. The relief is contingent upon a plethoric Treasury; it is, moreover, largely in the discretion of one man, the Secretary of the Treasury, whose impulsiveness or conservatism may materially affect the relief afforded. Finally, when determined upon, it is not always as speedy as desired. The Secretary of the Treasury can increase the money in circulation (1) by additional deposits in banks, (2) by anticipating payments, (3) by redemption or purchase of the public debt. Of these methods the first is gradual, as no transfers can be made from the Treasury to the banks, the latter's holdings increasing only by deposit of internal revenue and other general receipts. Moreover, banks have been unable, even during periods of stringency, to apply for funds that could legally be deposited with them, owing to the requirement that such funds were to be secured by deposit of national bonds—a requirement sometimes difficult to meet, because of the high price of such bonds. By an order of the Secretary, dated October 4, 1902, banks are permitted, under certain conditions, to substitute specified State and municipal bonds for the national bonds hitherto required. It is hoped that in this way the Treasury will be able to give a larger measure of relief than formerly. The second method applies chiefly to certain definite payments, like the interest upon the public debt. The third is the most satisfactory, so long as there is outstanding a redeemable debt, but cannot be free from criticism when the Government goes into the market to buy up its own bonds. Moreover, with the debt limit of the United States growing less, and with a larger part of the debt held by banks as a security for deposits or currency, this resource is growing weaker. Since any sale of bonds by banks would diminish the circulation in other directions, it is only the bonds held by individuals whose sale to the Government would affect the volume of the circulation. Hence the 'relief' which the Treasury can afford the monetary situation is spasmodic, irregular, and uncertain; it is very far from being a scientific automatic corrective of the excesses of the money market.

It is the opinion of those who have examined the matter in all its details that the independent Treasury offers the Government no advantages which could not be secured by properly guarded contracts with the banks. Such contracts would relieve the Government of the custody of its own surplus, and would not withdraw that surplus from the ordinary channels of trade. There is a growing feeling that our Treasury methods are antiquated, and should be replaced by methods more in harmony with business principles. It has been pointed out that if others should follow the example of the Government, business would come to a standstill. See Finance; Banks; Banking. Consult Kinley, *The Independent Treasury System of the United States* (New York, 1893).

INDESTRUCTIBILITY OF MATTER. See Matter.

INDETERMINATE COEFFICIENT. See Coefficient.

INDETERMINATE EQUATION. See Equation.

INDETERMINATE MULTIPLIERS. The use of indeterminate multipliers is well illustrated by Bezout's method of elimination in solving systems of simultaneous equations. E.g. let it be required to solve the system of equations,

$$(1)\quad 4x - 5y + 2z = 0.$$
$$(2)\quad 3x + 2y + 7z = 28.$$
$$(3)\quad x - y + 2z = 5.$$

Multiplying the members of the first equation by λ and those of the second equation by λ' and adding to those of the third equation, we obtain the equivalent system,

$$(4)\quad 4x - 5y + 2z = 0.$$
$$(5)\quad 3x + 2y + 7z = 28.$$

$$(6)\ (4\lambda + 3\lambda' + 1)\,x - (5\lambda - 2\lambda' + 1)\,y + (2\lambda + 7\lambda' + 2)\,z = 28\lambda' + 5$$

Selecting for λ, λ′ values such that

$$(7)\ 5\lambda - 2\lambda' + 1 = 0$$
$$(8)\ 2\lambda + 7\lambda' + 2 = 0,$$

then $\lambda = -\frac{11}{39}$, $\lambda' = -\frac{8}{39}$, and from equation (6), $x = 1$. Choosing next λ, λ′ such that

$$(9)\ 4\lambda + 3\lambda' + 1 = 0$$
$$(10)\ 2\lambda + 7\lambda' + 2 = 0,$$

then $\lambda = -\frac{1}{22}$, $\lambda' = -\frac{3}{11}$, and, from equation (6), $y = 2$. It may similarly be found that $z = 3$.

INDETERMINATE PROBLEMS. See DIOPHANTINE ANALYSIS.

INDETERMINISM. See INDIFFERENTISM.

INDEX (Lat., indicator). An alphabetical list of names, topics, words, and the like, with indications of the passages in which they occur. The index usually comes at the end of the book; the analytical table of contents is normally placed at the beginning, except in the case of French, Italian and Spanish books.

As books began to multiply the need of indexes was felt and their value was recognized. Many old books of the sixteenth and seventeenth centuries have well-made indexes of such fullness and value as put to shame the farcical substitutes issued by many modern publishers when they give any at all. Numerous authorities might be cited as to the worth of a good index in enhancing the value and usefulness of a good book. Long and loud have been and are the complaints against the publication of books of knowledge without indexes, emphasizing Carlyle's growl against "books born of Chaos, which want all things, even an index." Lord Campbell of England, and Horace Binney of Philadelphia, each advocated withholding copyright from any author who published a book without an index. "I have come," says the latter, "to regard a good book as curtailed of half its value if it has not a pretty full index. It is almost impossible, without such a guide, to reproduce on demand the most striking thoughts or facts the book may contain, whether for citation or further consideration." The value put by many scholars on the old Delphin edition of the classics is based on its copious indexes, by means of which a classical quotation can be made or located with the least trouble. Years of time have been lost to students and scholars in fruitless search for much wanted bits of information buried from sight in unindexed pages of books of value and authority. What the seeker demands is a complete index, and it is essential that this should not only refer to the letter, but should also embody the spirit of the work indexed. To this end the indexer must possess intelligence, quickness of perception, the power of analysis and condensation, and the ability to put himself *en rapport* with the author and his work, of the subject of which he must himself have a very considerable knowledge. Any index is valuable in proportion as it is concise in expression and accurately exhaustive, not only of the broader statements of fact or of opinion, but also of the small points of detail, the incidental and illustrative references contained in the book or volumes to which it aims to be the guide or key.

Minuteness of indexing must vary according to character and uses of books indexed. Before beginning to make entries, an indexer should read the book. He may then indicate by underlining text or writing chosen headings in the margins against the topics to be indexed. A book may require a general index of quite obvious subjects treated in it, as Bryce's *American Commonwealth;* a name or word index, as for atlases, botanies, quotations, etc.; an index of ideas more or less difficult to reduce to alphabetic key-words, as Emerson's *Essays*, Holmes's *Autocrat*. The indexer cannot be too careful in choosing headings or catch-words, which must not only represent the subject treated, but also be such as would occur to the seeker who has not the text before him. Entries on the same subject should not be scattered among various synonymous headings. Each subject must be indexed every time it occurs, and related matter should be indicated by cross-references. If entries under headings are few it is better to repeat them under each heading needed to make reference easy and complete; if many, a single heading may be chosen for entries and cross-references made from other possible headings. Entries should be concise, definite, and specific. Scattered page references should not be massed under a heading without clew to the character of the information given. Where matter relating to a single subject is given consecutively and is brief, a single reference may suffice, but if extended it should be analyzed under headings. In a book on municipal affairs, the seeker must not be forced to examine several pages on the Mayor of New York to ascertain his salary. Specific rather than general headings should be chosen; e.g. entry should be under potatoes, not tubers, sparrows rather than birds, cross-reference being made only when necessary. In general, indexing under the main subject of the book should be avoided. This would bring too great a mass together, and render the heading practically useless. The excellent index of Fiske's *American Revolution* has but seven entries under 'Revolution.' A work in several volumes should have a general index to all in the last one. Separate indexes to each volume (except for serials) are seldom afforded.

Each entry should be written on a separate slip and the slips alphabeted in trays. Library supply houses make slips 5 × 7.5 cm. or 7.5 × 12.5 cm., and trays to fit. The smaller size is usually better. Careful, final editing of entries is necessary to assure consistency, proper cross-reference, clear punctuation, and absolute accuracy. Words alike in spelling but different in meaning should be repeated as headings. Entries like the following are confusing:

Lead, copper
    metallurgy
    kindly light
    poisoning

Entries should be arranged in alphabetic order. Two or more distinct words should not be treated as integral parts of one word. Thus the arrangement should be:

New Bedford New reasons for New York Newark News from abroad Newton	not	Newark New Bedford New reasons for News from abroad Newton New York

When verified and edited, slips may be sent to the printer either pasted in order on large sheets, or numbered, punched, and tied together, or entries may be copied on sheets. Great care is essential in verifying both the original entries and the printer's work, an index error being serious. A paper on "Indexing," by J. B. Nichols in *Library Journal*, October, 1892, gives the best directions and suggestions in print for would-be indexers. H. B. Wheatley's *How to Make an Index* (London, 1902) is entertaining reading and valuable in suggestion. It contains the rules of the English Index Society. The American Library Association's *List of Subject Headings for Use in Dictionary Catalogs*, Cutter's *Rules for a Dictionary Catalogue* (Washington, 1891), and various articles referred to under *Index* and *Indexing* in Poole's *Index to Periodical Literature* are also useful. A study of well-made indexes and criticism of poor ones will aid materially.

INDEX, in mathematics. See Exponent.

INDEX (more fully Index Librorum Prohibitorum). A catalogue published by Papal authority in the Roman Catholic Church of books the reading of which is prohibited to members of that Church, whether on doctrinal, moral, or religious grounds. A natural consequence of the claim of the Church to authority in matters of religion is the right or the duty of watching over the faith of its members, and of guarding it against every danger of corruption from books believed to be injurious to faith or to morality. The earliest recorded exercise of this restrictive authority is the prohibition of the *Thalia* of Arius; and a council of Carthage, in the year 398, issued, even for bishops, a similar prohibition of Gentile books, although it permitted to them the reading of the works of heretics. The earliest example of a prohibitory catalogue is found in the decree of a council held at Rome (494), under Pope Gelasius, which, having enumerated the canonical books of Scripture and other approved works, recites also the apocryphal books, together with a long list of heretical authors, whose writings it prohibits. The mediæval popes and councils pursued the same course as to the heterodox or dangerous writings of their respective periods, and the multiplication of such books after the invention of printing led to a more stringent as well as more systematic procedure. Henry VIII. of England published a list of prohibited books in 1526, and a larger one (containing 85 titles) in 1529, in which year Charles V. published for the Netherlands his most noteworthy edict against dangerous reading, with a long list, which was included in that issued by the university press of Louvain in 1546, and again in 1550. Similar lists appeared by authority at Venice, Paris, and Cologne, and Paul IV. issued in 1557 and 1559 what may be regarded as properly the first *Roman Index*. One of the gravest undertakings of the Council of Trent was a complete and authoritative enumeration of all those books the use of which it was expedient to prohibit to the faithful. A committee was appointed for the purpose, and had made great progress in the work; but it was found impossible to bring the examination of the books to an end before the close of the council, and all the papers of the committee were handed over by the council to the Pope. When the work was completed, the result, known as the *Tridentine Index*, was issued with the bull *Dominici Gregis Custodiam*, by Pius IV. in 1564. From this time the burning of dangerous books fell into disuse, and the Church contented herself with warning her children against their use, under penalty of purely ecclesiastical censure. Further additions and certain modifications of the rules of this *Index* were made by Sixtus V., Clement VIII., Alexander VII., and Benedictine XIV. It was republished in 1595, and, with the addition of such books as from time to time it was deemed expedient to prohibit, in several subsequent editions, the most remarkable of which are those of Brasichelli (Rome, 1607); Quiroga, *Index Librorum Expurgandorum* (Salamanca, 1601); and Sotomayor, *Novissimus Index* (Madrid, 1648). In the intervals between the editions, the decrees which make further additions to the *Index* are published at Rome and circulated in the various countries. The latest edition of the *Index* is by Leo XIII. (Turin, 1895).

The prohibitions of the *Roman Index* are of two classes, either absolute and total, or partial and provisional, until the books shall have been corrected. The edition of Quiroga, mentioned above, gives a list of the latter class, known as *Index Expurgatorius*. The ground of the prohibition may be either the authorship of the work, or its subject, or both together. Under the first head are prohibited all the writings of *heresiarchs*—i.e. the first founders of heresies—no matter what may be the subject. Under the second head are prohibited all books confessedly immoral, and all books on magic, necromancy, etc. Under the third are prohibited all books of heretical authorship treating on doctrinal subjects; all versions of the Bible by heretical authors; and all books, no matter by whom written, which contain statements, doctrines, or insinuations prejudicial to the Catholic religion. The preparation of the *Index*, in the first instance, was committed to the care of the Congregation of the Inquisition in Rome; but a special Congregation of the Index was established by Pius V., and more fully organized by Sixtus V. This congregation consists of a prefect (who is always a cardinal), of consulters, and of examiners of books (*qualificatores*). Its proceedings are governed by rules which have been authoritatively laid down by several popes, especially by Benedict XIV., in a constitution issued July 10, 1753, which is the best and most authentic exposition of a subject on which much misconception exists. The edition of the *Index* by Brasichelli was reprinted, with an English preface, by Richard Gibbings (Dublin, 1837). By far the most elaborate study of its contents is by F. H. Reusch, *Der Index der verbotenen Bücher* (2 vols., Bonn, 1883-85). The same author also reprinted all accessible indices of the sixteenth century in the *Bibliothek des Stuttgarter litterarischen Vereins*, vol. clxxvi. (Stuttgart, 1886).

INDEX, Cephalic, Cranial, Pelvic, etc. A term employed by anthropologists to mark the proportions of certain related parts of the human body, especially of the head or cranium, in order to distinguish biological varieties in mankind. The most important of these, and the easiest to obtain, is the ratio of the width of the head to the length, called cranial index for the skull, and cephalic index for the living subject. To avoid the decimal point at the beginning of the index, the width of the skull is multiplied by 100 and divided by the length, the formula being thus $\frac{W100}{L} = I$. The extreme length is between the glabella and the most prominent portion of the occiput, and the width is the greatest breadth, wherever that may be. All appliances necessary for these measurements are a set of calipers and a rule, in centimeters or in inches.

Three terms are applied by anthropologists to heads, according to these measures. Those having cephalic indexes with a ratio below 80 are called dolichocephalic, those between 80 and 82 are mesocephalic, and those above 82 are brachycephalic. For crania, or skulls of the dead, the indexes are about two points lower. In the numerous cases where a finer subdivision is necessary, a quinary method of nomenclature is followed, the Germans adopting a series called the Frankfort Agreement, the French, the scheme of Broca, modified by Deniker, as follows:

	Cranial index	Cephalic index
Dolichocephals	below 75	below 77
Sub-dolichocephals	75 - 77.6	77 - 79.6
Mesocephals	77.7-79.9	79.7-81.9
Sub-brachycephals	80 - 83.2	82 - 85.2
Brachycephals	83.3-84.9	85.3-86.9
Hyper-brachycephals	85 and upward	87 upward

Dolichocephalic skulls of exceptional length have reached an index of 58, the lowest limit, while brachycephalic examples have gone as high as 90 or even 100.

Before proceeding to other indexes it should be stated that the cranial and cephalic indexes just described are far from being a perfect guide to the classification of mankind, for the subdivisions of the human species have no governing rule and are not subspecies, but separate varieties and mixtures, as with domestic animals.

Again, the ratio between the width and the length of the skull does not give complete information as to its shape. The measurements, therefore, lead to uncertain conclusions, since precisely the same figures would be obtained from crania or heads of widely different cross-section, so that one having an almost rectangular shape, an oval with a narrow end far in front, and a long ellipse would lead to the same index. Unless a large number of skulls among the same people are measured and give something like a uniform result, the measurements are an unsafe guide. Very little good arises from simply adding a number of indexes and dividing by a number of observations. The average result might be a number to which not a single head in the whole series measured would correspond. It is customary, therefore, to tabulate results by coördinates. Frequently, when such a plan is pursued there arise several apexes, as in Italy, the higher number representing the brachycephalic Northern Italians with Celtic blood in their veins, and the lower number the Southern long-headed Mediterranean type.

The cranial and cephalic indexes are not precisely coördinated with purely descriptive characteristics of the human body. It cannot be said that any one of the subspecies of man is either dolichocephalic or brachycephalic, but tendencies toward one or the other exist, as the following table of cephalic indexes shows:

Caroline Islanders (black)	69.4
Kashmirians (yellow-white)	72.2
Bakongo (black)	72.5
Hindus (white, mixed)	72.8
Karaya Indians, South America (red)	73.0
Australians (straight-haired blacks)	74.2
Norwegians (blondes)	76.0
Corsicans (white)	76.6
Spaniards of Valencia	76.8
British Isles	77-79
Parsis of Bombay (white)	82.0
Koreans (yellow)	82.6
Malays (brown)	82.8
Negritos, Philippines (black)	84.7
Arawaks, Guiana (red)	82.6
Saras, Chad-basin, Sudan (black)	82.4
Samoans (brown mixed)	83.7
Votyaks (yellow)	82.0
Walloons (white)	82.2
Italians (white)	82.7
Armenians (white)	85.6
Piedmontese (white)	85.9
Sudanese (brown)	86.3
Savoyards (white)	86.9
Tahitians (brown)	85.6
Aleuts (red)	87.8
Magyars (mixed)	87.8
Burmese (yellow)	85.7
Aissor, Transcaucasian (white-yellow)	88.7

Among the European whites the people of the British Isles are mesocephalic; of France the index is 78-88; of Italy, 75-87; of Spain, 77-80; Switzerland, 76-85, with two types, the long and the short head; Austria, 80-84.

Other indexes than those expressing the relation of width to length are also employed. The facial index is the ratio of the width to the height, from the glabella to the alveolar border, and separates skulls into brachyfacial and dolichofacial. The ratio of width to length in the orbital orifice separates crania into megasemes (90 and upward), mesosemes (89 to 84), and microsemes (below 84). The nasal index is the ratio between the width of the bony mass of the nose and its height, giving rise to leptorhine, or narrow-nosed, platyrhine, or flat-nosed, with the intermediate term, mesorhine. The dental index is based upon the importance which naturalists place on dentition in the classification of mammals. Upon the ratio of the size of the teeth to related parts, Flower divides men into megadont, mesodont, and microdont; and this series bears a surprising relation to the three anthropometric types of man—Negroid, Mongoloid, Caucasoid.

SCHEME OF PRINCIPAL CLASSIFICATIONS ACCORDING TO INDEXES

Skull	Dolichocephalic, long skulls. Mesocephalic, medium skulls. Brachycephalic, broad skulls.
Nose	Leptorhine, narrow noses. Mesorhine, medium noses. Platyrhine, flat or broad noses.
Eyes	Megaseme, round eyes. Mesoseme, medium eyes. Microseme, narrow eyes.
Teeth	Megadont, large teeth. Mesodont, medium teeth. Microdont, small teeth.
Jaws	Orthognathic, straight or vertical jaws. Mesognathic, medium jaws. Prognathic, projecting jaws.
Face	Chamæprosopic, low or broad face. Mesoprosopic, medium face. Leptoprosopic, narrow or high face.
Pelvis	Platypellic, broad pelvis. Mesopellic, medium pelvis. Leptopellic, narrow pelvis.

Consult: Roberts, *Manual of Anthropometry* (London, 1878); Török, *Grundzüge einer systematischen Kraniometrie* (Stuttgart, 1890); Deniker, *Races of Man* (London, 1900); Livi, *Antropometria* (Milan, 1900); Boas, *Stone's Measurements of Natives of the North-West Territory* (New York, 1901).

INDEX EX'PURGATO'RIUS. See INDEX.

INDEX KEWENSIS. A reference book of the names of flowering plants, accepted as authoritative throughout the world. It was conceived by Darwin, who, having experienced difficulty in definitely identifying many of the plant species with which he worked, provided the money for its completion. It was compiled by Benjamin Daydon Jackson (q.v.), whose aim was to record every genus and species of phanerogamous plants published up to 1885; to follow Bentham and Hooker's *Genera Plantarum* as authority for the limitation of genera; to add to each name, whether retained or synonymic, a full reference to its place of publication, retained names being the earliest under which they were published in the recognized genus and not necessarily the earliest specific names; and, finally, to indicate the geographical distribution of each species. Two supplements, bringing the work down to 1895, and embracing specific names between Aalius and Irika, appeared in 1902. In these the author was assisted by Theophilus Durand of Brussels.

INDEX LAWS. See EXPONENT AND EXPONENTIAL.

INDEX NOTATION. See NOTATION.

INDEX NUMBERS. An index number is a method adopted by statistical and economic writers to exhibit the course of prices of a group of commodities or of commodities generally.

A crude method of attaining this result is to add the prices of the various commodities together. The defects of such a procedure are apparent from the following simple illustration:

	1st date	2d date
Cotton, per lb	$0.08	$0.07
Flour, per bbl	3.50	3.25
Pig iron, per ton (2000 lbs.)	18.00	18.50
Total	$21.58	$21.82

If the sum be a criterion, it appears that there has been on the whole an advance in price of the group despite the fall in cotton and flour. A little reflection will show that had pig iron been quoted by the pound instead of by the ton the result would have been different, as follows:

	1st date	2d date
Cotton, per lb	$0.08	$0.07
Flour, per bbl	3.50	3.25
Pig iron, per lb	.009	.00925
Total	$3.589	$3.32925

But even here there are still great differences in the initial prices and the variations are measured on very different scales.

The index number avoids this difficulty by reducing the initial prices to common terms. It establishes the variation of each price from its own starting-point, and then determines the average variation. The assumed figures above given will serve the purpose of demonstration, and the following statement of relative prices is true for either of the series:

	Price at 1st date	Price at 2d date in terms of price at 1st date
Cotton	$100	$87.5
Flour	100	92.9
Pig iron	100	102.8
Total	$300	$283.2
Average	100	94.4

In this comparison, where each article has an equal weight in determining the result, there appears to have been a fall in price of 5.6 per cent.; while in the first statement, where pig iron predominated, a rise in price of 1.2 per cent. appeared, and in the second statement, where flour predominated, the fall in price appeared to be 7.2 per cent. It is obvious that the third statement or simple index number is a far better indication of the course of prices of these articles than the other two, where one article or the other dominates the result simply by reason of the fortuitous circumstance that its unit of measurement is relatively large.

The third statement is not, however, an absolutely exact measure of the total price change, since it is not of equal significance that flour falls and that pig iron rises. To the individual consumer no doubt a slight fall in flour is more important than an equal rise in pig iron. It may readily be assumed that he buys for his daily needs 10 times as many things affected by the price of cotton as are affected by that of pig iron, and perhaps four times as many affected by the price of flour as are affected by that of cotton. His relative consumption might be: pig iron, 1; cotton, 10; flour, 40. Hence the price changes noted affect him in varying measure, and this must be accounted for in estimating the significance of the total change. The calculations are as follows:

	Price	Units of importance	Product
Cotton	$87.5	10	875.0
Flour	92.9	40	3716.0
Pig iron	102.8	1	102.8
Total	$283.2	51	4693.8
Average	94.4	...	92.0

On the other hand, in the aggregate consumption of the nation the proportions of the different articles might be quite different, and hence also the significance of these combined changes in the wholesale market. Let us assume them to be: pig iron 1, cotton 2, and flour 4. We then have the following calculation:

	Price	Units of importance	Product
Cotton	$87.5	2	175.0
Flour	92.9	4	371.6
Pig iron	102.8	1	102.8
Total	$283.2	7	649.4
Average	94.4	...	92.8

We have now determined by these slightly different methods the price of the group to have been at the second date, compared with the first, as 94.4, 92.0, and 92.8 respectively are to $100, and we have in these results from assumed figures a fair illustration of the methods of index number calculations, and the problems to which they give rise.

The problems of a general index number are not dissimilar. The first is the choice of articles whose prices are to be included. No definite statement of what articles should or should not be comprised in the index can be made except that they should be staple articles of general use. It would defeat the object of an investigation aiming to determine the course of general prices, to include specialties, or rarities, or objects of such restricted use as not to be subject to the ordinary influences affecting prices.

The character of the component price series being thus stated, how shall the number be fixed? It must evidently be large enough to include all the more important lines of staple commodities. No precise limit can be fixed. While it would seem obvious that in any effort to determine general prices, the greater the number of commodities embraced in the comparison, the more accurate the result, such is not the case, since, as the number multiplies, the proportion of articles of limited demand which are more or less removed from the primary influences affecting prices generally increases.

The base line with which prices are compared is usually the average of a series of years, the purpose of taking such an average being to overcome any eccentricities of prices which might characterize a briefer period of time. This practice is not universal, and some well-known calculations have been based upon the prices of a single year. This method is justified on the ground that the prices so chosen were those of normal conditions.

In the combination of the price series into a general index of prices, the simple mean is the most frequent method employed, as illustrated in our first index calculation. This has been the subject of much criticism on the ground of the unequal importance of the objects concerned. To overcome this difficulty two sets of weighted averages have been proposed. The first was one which measured all articles by their importance in the national consumption as illustrated in the third calculation; the second measures articles by their importance in individual consumption as revealed by family budgets and typified in our second calculation. In applying national consumption as a test, we find that calculations of such consumption are very precarious and extend to comparatively few articles. In family consumption we can ascertain for certain groups of persons the proportions of expenditure which cover a much wider range of commodities. But the commodities covered by the family budgets are not the same as those covered by price statistics, since the former represent the retail, and the latter the wholesale markets. In the food products this makes little difference, but in textiles, metals, lumber, and the like there is no little adjustment needed to bring the prices and the relative expenditures into relation.

Those who have done the most to establish more rational and at the same time more complicated calculations have been the first to point out that the ultimate results differ but slightly from those obtained by the somewhat rough calculation of a simple average.

The index number of the London *Economist* is based upon the wholesale prices of 47 commodities which by combination are reduced to 22. The quarterly prices for 1845 to 1850 were arranged as a basis for calculation and the relative prices for subsequent years upon the January prices. The total price index for 1845 to 1850 was 2200, and for later years the price indices are also expressed as an aggregate, without reduction to 100. As in a few cases the full number of articles was not given, this was somewhat misleading. In the following table we give the results of this calculation as published by the *Economist*, together with a reduction to the scale of 100:

"ECONOMIST" INDEX NUMBER

YEAR	Total as published	Reduced to scale of 100	YEAR	Total as published	Reduced to scale of 100
1845–50	2,200	100	1879	2,225	101
1851	2,293	104	1880	2,538	115
………	………	………	1881	2,376	108
1858	2,612	119	1882	2,435	111
………	………	………	1883	2,342	106
1861	2,727	124	1884	2,221	101
1862	2,878	131	1885	2,098	95
1863	3,492	159	1886	2,023	92
1864	3,787	172	1887	2,059	94
1865	3,575	163	1888	2,230	101
1866	3,564	162	1889	2,187	99
1867	3,024	137	1890	2,236	102
1868	2,682	122	1891	2,240	102
1869	2,666	121	1892	2,133	97
1870	2,689	122	1893	2,120	96
1871	2,590	118	1894	2,082	95
1872*	2,835	129	1895	1,923	87
1873	2,947	134	1896	1,999	91
1874*	2,891	131	1897	1,946	88
1875	2,778	126	1898	1,891	86
1876	2,711	123	1899	1,918	87
1877	2,715	123	1900	2,145	98
1878	2,529	115	1901	2,125	97
			1902	1,948	89

* Twenty-one articles only.

The general tendencies of price movements, the rising tendency till 1873, and the subsequent downward trend as shown in these figures are amply confirmed by other investigations. The enormous rise in the period of 1861 to 1865 was due not only to the extravagant prices for cotton paid in this period, but also to the fact that in the twenty-two series represented in the total as many as three were for cotton. This fact, and the prominence given to indigo, and the absence of so important a staple as coal, led to numerous efforts to improve the calculation. Mr. R. H. Inglis Palgrave sought to remedy the defects by a system of weighing each article by its importance in the national consumption—a method already indicated.

Mr. Augustus Sauerbeck published in 1886 in the *Journal of the Royal Statistical Society* an index number which has been brought down to date in subsequent issues of that periodical, and which is in many respects an improvement upon the older calculation. His annual prices are based upon averages of the monthly, and in some important commodities weekly prices, and these are compared with the average prices of 1867 to 1877. The tables embrace 45 series of quotations; and while some commodities are repeated (in different grades), they have been chosen in such a manner that the total number of quotations for a group of commodities such as meats, textiles, iron and steel represents approximately in its proportion to the whole number of quotations—forty-five—the importance of this group in the commerce of the United Kingdom. The superiority of this calculation rests, therefore, on the more trustworthy character of its material, and the breadth of choice.

In France similar calculations have been based upon the import prices of commodities, and in Germany (Soetbeer's) upon the import prices of goods at Hamburg. The latter are more comprehensive, since Hamburg was so long a free city that practically its entire trade was in commodities imported by sea and land. The calculations of Dr. Soetbeer for Hamburg, based on the average prices of 1847 to 1850, embraced 100 articles, to which were added 14 articles from the British trade returns. Neither the more limited French calculations nor those of Dr. Soetbeer developed any mode of combination other than the simple average.

In the United States comprehensive statistics of prices for the period of 1840 to 1891 were published in the Senate report on wholesale prices, wages, and transportation. The report based its calculations upon the prices of 1860 and furnished an index number comprising 223 different series of prices. These were combined by the method of simple average, and also by estimating the importance of the price series as measured by family consumption. As in previous instances when different methods of combination had been tested upon the same figures, the results of the two methods differed but little. This price index closed with 1891, but the United States Department of Labor in its *Bulletin* has furnished the material for carrying the study of price movements down to the present day.

It should perhaps be mentioned that this report applied the index-number principle to its statement of wage statistics, a procedure which had been previously suggested, but was carried here to execution for the first time. It is also applied effectively to the study of transportation rates. The methods of the report, especially as applied to wages, have been made the subject of searching criticism by the English statistician A. L. Bowley, who has effectively used the index principle in his investigations of the course of wages in England.

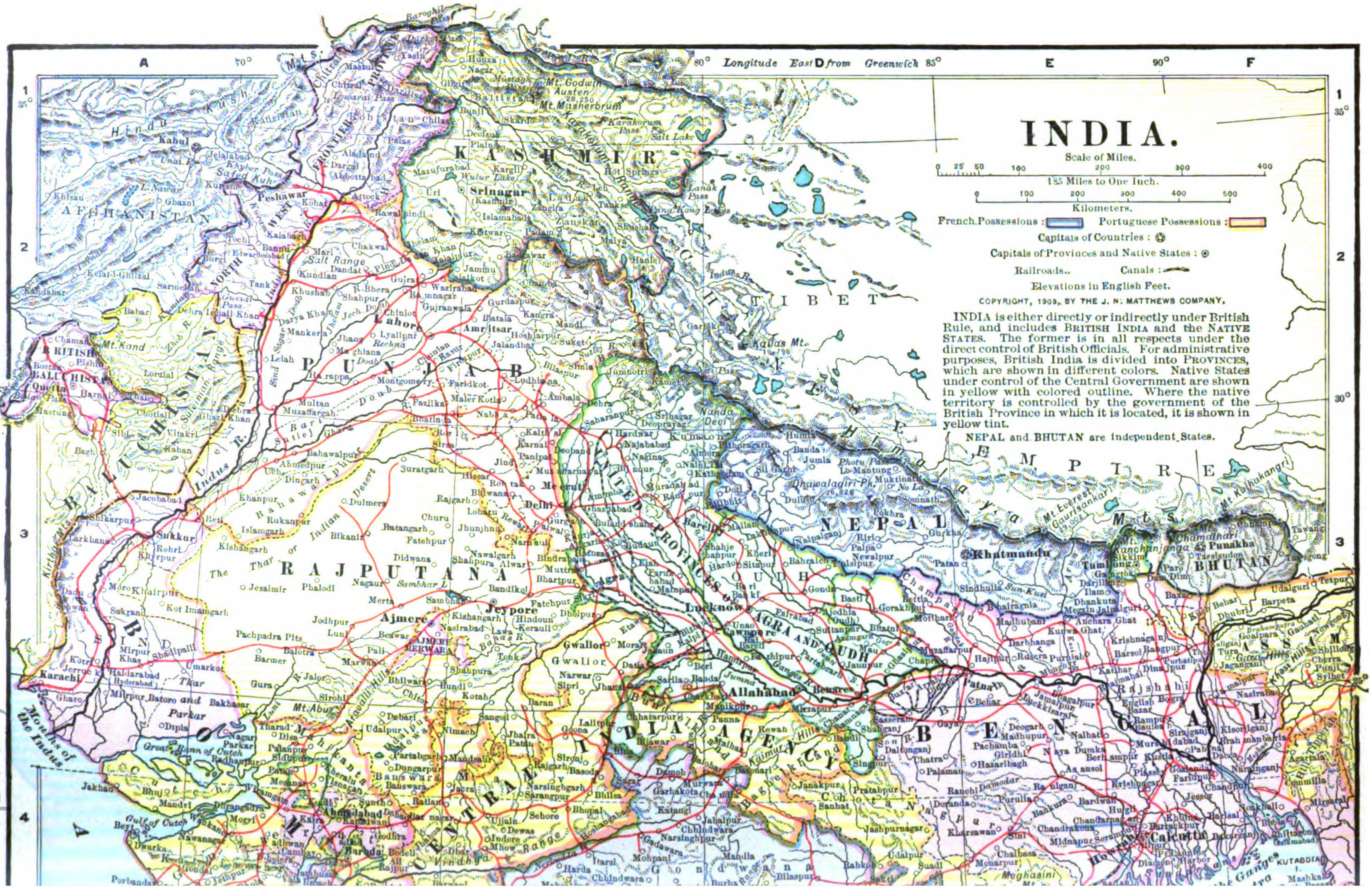
Consult: Bowley, *Wages in the United Kingdom* (Cambridge, 1900); id., *Elements of Statistics* (London, 1901); Falkner, *Wage Statistics in Theory and Practice* (Boston, 1899), in *Publications of the American Statistical Association;* Mayo-Smith, *Statistics and Economics* (New York, 1899); *Senate Report 1394*, Fifty-second Congress, second session, 1893, four volumes.

INDEX OF REFRACTION. See LIGHT.

INDIA. A region comprising the middle member of the three great southern peninsulas of Asia and a territory of nearly equal extent to the north, together with an extension eastward as far as the Malay Peninsula. India in this sense constitutes the Empire of India, one of the members, and by far the most populous, of the British Empire. India proper, however, does not extend farther east than the head of the Bay of Bengal; nor does it include some of the northern or westernmost districts of the Empire. The name Hindustan was formerly frequently used instead of India, but it belongs more properly to the north-central portion of India, the land of the Hindus. The name India has been used in a very broad sense, but improperly, so as to embrace the great southeastern peninsula of Asia, which is still sometimes spoken of as Farther India. This article will treat of the Empire of India. Since British influence became predominant there no other country of the Asian mainland has been so diligently explored or is now so well known as India. In the form of a great triangle, the Indian Peninsula extends southward between the Bay of Bengal, on the east, and the Arabian Sea, on the west, through 15° of latitude to Cape Comorin (latitude 8° 5′ N.). On the north the peninsula unites with the continental mass in the lowlands of the Ganges Basin and the great plains east of the Indus, which connect it with the mighty highlands of the Himalayas. India, within the official boundaries of the British possession (including the Native States), stretches north and south through about 29° of latitude. Its east and west extension is across nearly 40° of longitude. The Empire has an area of about 1,860,000 square miles, including the Native States and dependencies (Baluchistan, etc.). (See INDIA, NATIVE STATES OF.) It is thus about half as large as the United States (inclusive of Alaska). It is a world in itself, for the great barrier of the Himalayas, the Hindu Kush, and the Suleiman Mountains shuts it off from land communications with the rest of Asia, except through very difficult mountain passes; the sea is the only means of easy approach. Thus guarded, though by no means completely, by mountain bulwarks and wide seas against intrusion, India was able to develop a civilization and social system peculiar to itself.

TOPOGRAPHY. The coasts of India are comparatively little indented except at the mouths of the larger rivers and along the northwest shores; and though there are many roadsteads and harbors for small vessels, there are only a few good harbors for large vessels, and they are in the deltas of the rivers, or, as at Bombay, under the shelter of islands. The railroad system was, therefore, planned so as to connect all the leading trade centres of the interior with the largest seaports.

Three distinctly defined physical regions are recognized—the mountain districts of the Himalayas, the low plains of the three great rivers of North India, and the high plateau of the Deccan, extending from the plain of the Ganges to the south end of the peninsula. The colossal ranges of the Himalayas, 1500 miles in length, extend along the north part of the country in several parallel chains separated by deep valleys and tablelands. The most northerly of these ranges is the loftiest, and Mount Everest or Gaurisankar, the highest mountain in the world, rises to a height of 29,000 feet. In the west the Himalayan ranges are continued by the Hindu Kush, from which the Suleiman and Hala chains stretch to the south, along the western borders of India. The barrier presented by the Himalayas is far more formidable than those of the other ranges, and can be crossed only by passes of 17,000 to 19,000 feet in height, above which tower many snow-capped summits. It was through the less difficult but still formidable passes on the northwest border that India was long subjected to invasion; and Burma was the victim of similar attacks through the passes on its northern frontier. The mountain rampart has the greatest influence on climate and fertility, for it wards off the freezing winter blasts from the north and condenses the immense volume of water vapor brought by the summer monsoon to vivify the plain below. The barren mountain slopes fall to the south in successive terraces down to the fertile plain teeming with animal and vegetable life. But while the higher slopes of the mountains are devoid of vegetation, some of the wide, high mountain valleys are exceedingly beautiful, most notably that of Kashmir, unexcelled for healthful climate and fertile soil.



INDIA.

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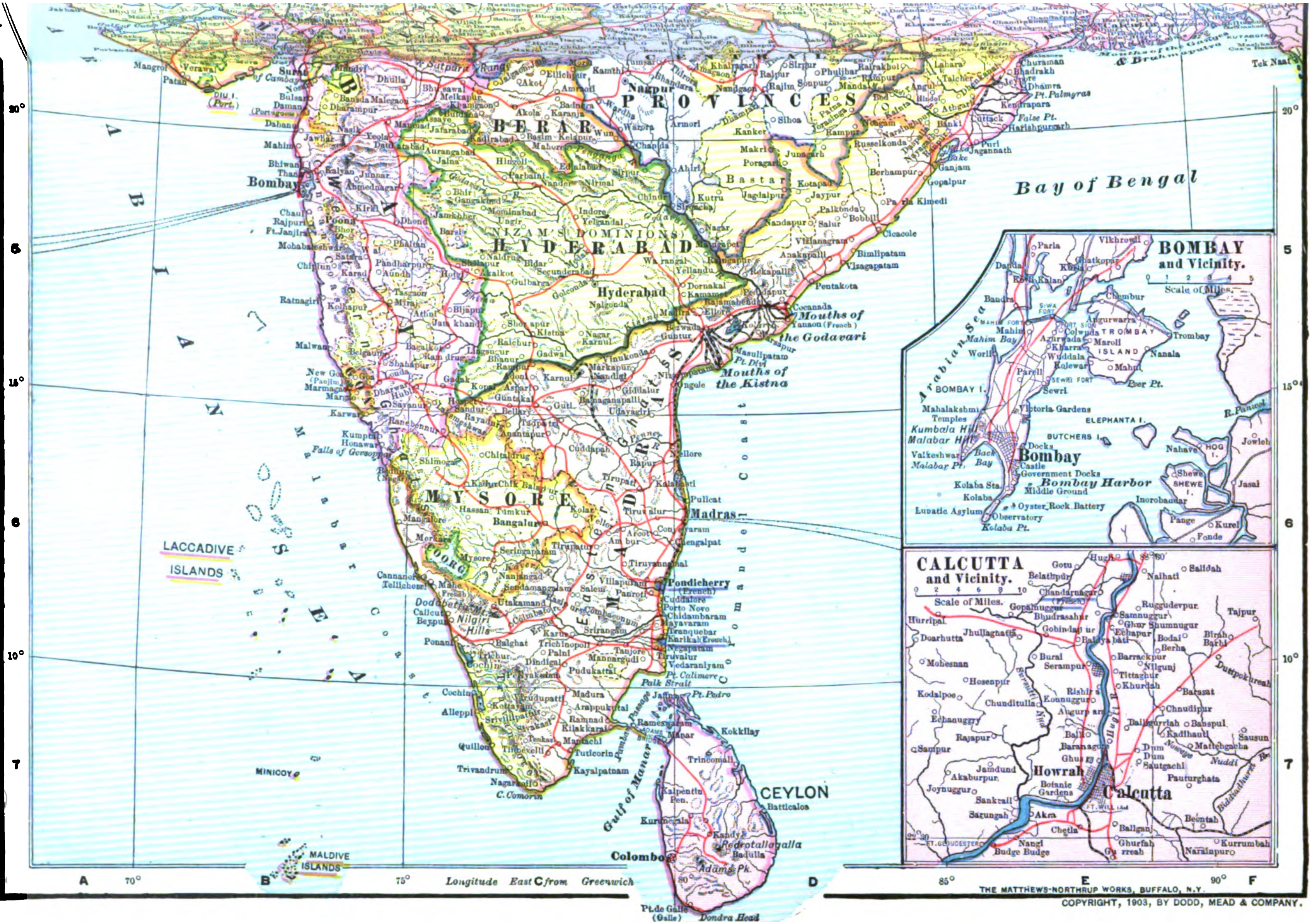
INDIA is either directly or indirectly under British Rule, and includes BRITISH INDIA and the NATIVE STATES. The former is in all respects under the direct control of British Officials. For administrative purposes, British India is divided into PROVINCES, which are shown in different colors. Native States under control of the Central Government are shown in yellow with colored outline. Where the native territory is controlled by the government of the British Province in which it is located, it is shown in yellow tint.

NEPAL and BHUTAN are independent States.



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The great river plains cross India in a wide belt from east to west, south of the mountains; and at their ends the plains are projected southward, where the Indus and the Ganges-Brahmaputra have advanced their deltas far seaward. On the alluvial lands are the densest population and the richest cultivation; for density of population is determined in India, not by the temperature, but by the supply of water available for the farms. But there are waste and almost unpeopled districts also among these lowlands; and the rainless Desert of Thar or Indian Desert, to the east of the Indus delta, extends northeastward almost to the base of the Himalayas.

The third topographic division of the country is the peninsula, the great triangular plateau of the Deccan, from 1600 to 3000 feet above the sea. The northern boundary of the plateau is the Vindhya Mountains, which join the plateau to the low plain. The Deccàn triangle is further defined by the Western Ghats rising above the fertile and accessible Malabar coast, and in the east by the Eastern Ghats overlooking the Coromandel coast, which is difficult of access, for the harbors are few and very poor. No other part of the world testifies more eloquently than the Deccan tableland to the prodigious energy formerly displayed by plutonic forces. The greater part of this immense plateau was built up by outpourings of lava and basalt (trap), which in places are 6000 feet thick.

The coast-line of Burma is not deeply indented except where the projecting delta of the Irrawaddy forms the Gulf of Martaban. The low coast and the flooded valleys make Burma the greatest producer of export rice in the world. Farther inland, to the east of the Irrawaddy and on both sides of the river in its upper course, the country is hilly and heavily forested.

Hydrography. The four great rivers of India are the Indus, the Ganges, the Brahmaputra, and the Irrawaddy, the last named in Burma. The heaviest rainfall is not on the plains or on the southern plateau, but on the slopes of the mountains, which pour their torrents into the great rivers below, with the result that the Ganges and the Brahmaputra carry to the sea a volume of water that is entirely out of proportion to their length or the area of their drainage basins. The Indus contributes to the basin of the Arabian Sea the waters derived from the Punjab (land of five streams), and from the plateau of Afghanistan. It is navigable for over 900 miles, but its value as a water highway is small on account of the impetuosity of its current. It is least important among the great rivers. The majestic and smoothly flowing Ganges is far more valuable for navigation than any other river of India. Both the Ganges and the Brahmaputra, which joins it near its mouth, are turbid with fertilizing silt from the mountains, which has formed the great Bengal delta. The Irrawaddy of Burma is navigable by steamers to Mandalay. The rivers of the peninsular part of India, though some of them are of considerable length, are not important for navigation. Among them may be mentioned the Nerbudda (Narbad) and Tapti, both flowing into the Arabian Sea, and the Mahanuddy (Mahanadi), Godavery (Godavari), Kistna (Krishna), and Kavery, which pour their waters into the Bay of Bengal.

Climate. On account of the great extent of India and its differing altitudes, the country has many differences of climate. The whole land may be described as more or less tropical except in the higher altitudes. Slopes of the Himalayas, as high as they are habitable, enjoy a temperate climate; neither is there for the natives an oppressive degree of heat on the high plateau of the Deccan. Among the Himalayas and the Nilgiris Europeans have established sanatoriums amid the most agreeable climatic conditions, where many of them take refuge from the prostrating heat of the hot months. The climate of India, except in the districts of jungle and marsh lands, is not, on the whole, unhealthful for the white race if the ordinary precautions required in all hot countries are observed. The most heated area is that of the northwest, in or about the region of the Indian Desert, where the mean July temperature exceeds 95°.

By far the most important climatic element is the rainfall, upon which depends the very existence of the people. Throughout the country in general there are only two seasons, the dry and the rainy, also known as the season of the northeast monsoon and the season of the southwest monsoon. These names are derived from the direction of the winds prevailing in the Arabian Sea and Bay of Bengal during the two periods. They are really inapplicable, however, over a great part of India, where the winds are from directions nearly opposite to those indicated by the names of the seasons, and are chiefly determined by the axial directions of the local river valleys. Thus the winds in South Bengal are from the southeast, and in Behar from the east, during the southwest monsoon, and are from the opposite directions in the northeast monsoon. The two seasons in India might, therefore, more appropriately be called the dry monsoon and the wet monsoon, from their most characteristic features.

The dry monsoon or season usually begins in November or December, and continues until May. Winds of land origin prevail more or less steadily in the interior, and hence the period is usually marked by great dryness of the air and little or no rain. The first three months of this period (December to February), characterized by a comparatively low temperature, are known as the cold-weather season; and the second three months (March to May), when the temperature increases rapidly and culminates in a period of excessive heat in May, as the hot-weather season. During the cold-weather season storms of large extent, the majority of which form in Persia, enter India from Beluchistan and traverse Northern India from west to east, distributing light rains in the Indo-Gangetic plains and heavy snow over the Western Himalayas. The severity of the hot-weather season is occasionally relieved by the occurrence of thunder-storms and dust-storms, which cool the air for brief periods. The characteristic features of the dry season are persistent dry weather, with clear skies, and large diurnal range of temperature.

The rains of the wet season or the southwest monsoon set in suddenly on the west coast of India in the first week of June, and a little later (in the second or third week of June) on the Bengal coast, and extend more or less rapidly into the interior. The prevailing winds of this period are of oceanic origin, and are, in fact, the northward extension of the winds of the southeast trades. The extension of these winds northward across the equator and up the Indian seas usually begins in the third week of May and gives a complete and permanent change of weather (lasting for five or six months), more especially over the land area of India. The winds due to the extension of these massive humid air-currents usually begin to give daily rain to the Malabar coast in the last week of May, and to the Bombay coast on June 4th or 5th. The humid currents advance more slowly into the interior, but are usually established before the end of the month over the whole of India. Cloudy, showery, or rainy weather, with a moderately high temperature and small diurnal range of temperature, prevails during the next three months, which are in striking contrast with the excessively hot and dry weather that has prevailed during the previous two or three months. Over the mountain tracts of Assam and over the plains of Lower Burma the yearly rainfall exceeds 500-600 inches, and in one particular year the record of 805 inches was established.

Sometimes the wet monsoon is greatly delayed or has little strength, and this failure of an adequate supply of rain involves the direst tragedy. (See section on *Famines.*) India and the adjacent seas are often visited by the destructive hurricanes called typhoons, whose tracks are frequently traced by ruined towns and crops.

The soil, except on the steep mountain slopes, is of great fertility, being largely composed of alluvium throughout the plains and in the mountain valleys, and of disintegrated volcanic rocks, from which many rich soils are derived, on the southern plateau. The food demands of the enormous population make it necessary to maintain a high degree of fertility.

Flora. The very unequally distributed rainfall causes great differences in vegetation. The almost rainless region just east of the Indus has desert conditions of plant life, while the low-lying coast lands along the Gulf of Bengal have large areas of dense, wet jungle. The plains of the Deccan east of the Western Ghats have little rain, for it falls on these mountains instead of on the plains. Vegetation is therefore sparse where irrigation is not applied; while the lower slopes of the northern mountains, drenched with rain, are densely wooded; and far above the forests there is an Arctic flora close to the glaciers and snow-fields. The greatest possible area of plowed fields is needed for food production, and so a large amount of forest area has been cleared for cultivation. Timber supplies are chiefly derived from the mountain slopes, from the hilly lands of parts of the Deccan, and from Burma. Teak, the most valuable wood, is cut on the slopes of the Western and Eastern Ghats, in Lower Burma, and to some extent among the western hills of the Deccan. Sandalwood and blackwood are found in the teak-growing regions; sal, another hard wood, and cedars, on the slopes of the Himalayas; and the common woods are scattered, not profusely, over various parts of the country. The larger part of the plain has no forests, and in the irrigated districts there are few trees except in the watered gardens. The Government has all the best timber areas under protection, and applies forestry methods to their management. The bamboo, the mango, and the cocoanut and other palms are widely distributed, and are of the greatest utility. One of the most distinctive of the Indian trees is the banyan. The forests of Assam, Malabar, and the lower slopes of portions of the Himalayas are luxuriant in the extreme, and present a wealth and variety of vegetable forms which are equaled or surpassed only by the forests of tropical America. In the Himalayas is the home of the giant rhododendron. Orchidaceous plants are markedly numerous, and the upper floral zones of the mountain range have furnished the most valuable types to the floriculturist.

Fauna. The country forms a part of the Oriental Region (q.v.) of zoögeography. Although the plains of the northwest partake of the characteristics of Central Asia, India possesses the lion (in the northwest, but now nearly extinct), the wild ass, and sundry smaller mammals, birds, and reptiles that belong rather to the country westward. The massive ranges of the Himalaya also contain a peculiar montanic fauna. characterized especially by an abundance of wild sheep, goats, and of goat-antelopes (qq.v.), such as the Charal Pulis sheep, the ibex, markhor, goral, and others elsewhere described. These, too, are more closely related to Palearctic than to Oriental forms; but two or more species of goats exist on the Nilgiri Hills and other heights of the Peninsula. The forests, swamps, and grassy plains of Peninsular India support life in extraordinary profusion, and civilization seems to have little effect upon it because of the jungle fastnesses to which animals may everywhere retreat and be safe. The elephant (which is still met with in many parts in large herds), however, requires protection, and the wild cattle are becoming scarce. Several kinds of deer, including the sambur, axis, and swamp-deer, and several kinds of antelopes are numerous, as well as very many of the minor mammals.

India is the home of the gallinaceous tribe of birds, and is rich in many kinds of pheasants, partridges, and jungle-fowl (to which is traced the origin of domestic poultry), besides a rich avifauna of the woods and fields. With this plenitude of prey, to which may be added a great variety of fresh-water and marine life, including many valuable food-fishes, there would naturally be found carnivorous beasts, rapacious birds, and poisonous predatory reptiles. The tiger (which is probably indigenous to India), leopard, cheeta, and several lesser cats wander throughout the whole country, and are dangerous to man as well as beast. Other animals are the rhinoceros, gayal (or bison of the Ghats), bear, jackal, and various forms of ape. The true buffalo, as well as the camel, is domesticated, and is largely used in the service of the field and farm. India is famous also for venomous snakes (see **Cobra**, etc.), crocodiles, and sea-snakes. The deaths of human beings by wild beasts and snakes number thousands each year, and the loss of cattle reaches hundreds of thousands of dollars in value. On the other hand, India is one of the most attractive regions of the world for sportsmen, who annually distribute much wealth within its confines.

Geology. The topographic divisions of India with their characteristic features are based largely upon differences in geological structure. The main system of the Himalayas, so far as explored, has been found to be composed of crystalline strata—gneisses, schists, and igneous rocks—which show the effects of upheaval and folding during the great crustal movements that elevated the ranges in late Tertiary times. In the southern flanking chains, or sub-Himalayas, the most prominent formation comprises Tertiary sandstones, conglomerates, and clays, in disturbed position. These strata (the Siwalik group) are enormously developed, and contain a remarkable assemblage of fossil mammals. The great river plains of India occupy depressions in sedimentary strata, mostly of Eocene age. The Deccan plateau is formed largely of basalt which poured out from great fissures during the Cretaceous period. These basaltic sheets occupy an area estimated at 200,000 square miles, and attain a vertical thickness of several thousand feet. The Vindhya Mountains on the north have a gneissic axis, with Paleozoic sediments on the flanks. East and south of this range there is a large area underlain by sandstones and shales, to which the name Gondwana system has been given. This group extends probably from the Permian to the Jurassic period; its fossil fauna and flora are more nearly allied to the life-forms of South Africa and Australia than to those of the Eurasian continent.

Mining. Considering the extent of area and the large population, the mining industry is strikingly insignificant, though the recent developments are beginning to give it some importance. Increased utilization is being made of the coal resources of the country, much to the advantage of the railroad and milling interests. The annual output of coal increased from 2,562,000 tons in 1893 to 6,095,000 tons in 1900. The Province of Bengal produces over three-fourths of the total product, the output having grown from 1,915,000 tons in 1893 to 3,883,000 tons in 1899. The principal other coal-mining regions are the Nizam's Dominions, Assam, the Central Provinces, and Central India (Rewa), in each of which the output was greater in 1899 than in any preceding year. The increased production has resulted in the decrease of the imports of coal—which amounted in 1900 to only 83,200 tons—and the increase in the exports of coal, amounting to 541,400 tons in the same year. Coolie labor is prominent in the working of the coal-mines.

The mining of gold is also rapidly becoming important, the yield having steadily increased from 107,273 ounces in 1890 to 513,266 ounces in 1900. The greater part of this is mined from the quartz deposits of Mysore, although some gold is obtained from river gravels in the Himalayas and elsewhere. A parallel growth is being made in the production of petroleum, the output in 1900 having been nearly 38,000,000 gallons, the greater part of which was obtained from Upper Burma. The importation of mineral oil is still more than twice as great as the home production. The Government has long maintained a monopoly in the production of salt. It is obtained mainly by the process of evaporation, and the industry is carried on along the coast region and at some of the interior lakes. The annual yield is estimated at about 1,000,000 tons. Saltpetre is obtained in the plains, lead and copper are mined in the Himalayas, and tin and rubies in Burma. India was long famous for its diamonds, but the output in the last century has shrunk into insignificance.

Agriculture. This industry, which has always been the principal source of subsistence for the people of India, is increasing in importance under British control, as improved means of production and transportation enable foreign manufacturers to deprive native artisans of their occupation, forcing them back to dependence on the cultivation of the soil. The land of India, though varying in composition, is generally fertile and is very productive, being aided by the tropical climate. The country is kept in continuous danger, however, of crop failure and consequent famine by the general uncertainty of rainfall. Practically the only districts exempt are the southwestern Malabar Coast, the Deltaic district of the Ganges, Brahmaputra, and Burma. (See section on *Climate.*) In some regions, as in the lower Ganges Valley, the precipitation is ordinarily quite heavy, rarely failing to meet the needs.

Irrigation. From remote times the inhabitants of India have sought, by means of artificial water-supply, to protect themselves against the calamities of drought. Under British control the irrigation works have been enlarged and new ones constructed on an enormous scale. In 1900 there were 31,544,000 acres, one-seventh of the total crop area, under irrigation. This was over four times the area irrigated in the United States, which ranks next to India in this respect. The area actually irrigated varies with the lack of rainfall from year to year, and the commercial value of irrigation schemes varies in different sections. In Sindh and Lower Punjab irrigation is necessary every year. In the valley of the Indus the necessity for irrigation decreases with the distance from the Himalayas, but the system is used as a protection against drought years, and to supplement the rainfall of average years. This is true also of the Upper Ganges region. In the Lower Ganges valley, as indicated above, irrigation becomes less and less necessary toward the Deltaic region, in portions of which the danger of drought gives place to that of inundation. In Madras (except the west coast) and the Deccan or Central India region, irrigation is a practical necessity as a protection against frequent droughts, and to supplement the usual rainfall. On the east coast of Madras, especially where 'wet crops' principally are grown, irrigation is an absolute necessity. In Orissa and Upper Bengal, though the ordinary rainfall is quite adequate and droughts seldom occur, the Government has constructed irrigation works as a safeguard against dry periods. These works are considered indirectly profitable to the Government, however, since they obviate the loss of land revenue and the expense of supplying a famine-stricken district with food during a drought year. The Orissa and some of the other canals are also valuable for navigation.

The sources and methods of irrigation vary throughout the country. Before the British occupation wells were used chiefly, and have continued to increase in absolute, though not in relative, importance, because, where practicable, they constitute the cheapest method. They are generally employed by private enterprise, and are still the largest source of irrigation in the United Provinces of Agra, Oudh, and Gujarat. Reservoirs, generally called tanks, have been used since ancient times to furnish water for irrigation, and are especially adaptable to broken, hilly regions, where the construction of a long system of canals is impracticable. They are found chiefly in the eastern portion of Madras, where they vary in size, according to the supply of water and the irrigable area which they command. In many instances they are dry during a part of the year, and crops are sometimes raised in them. This tank system is also carried on by private enterprise. But since India has been in the hands of the British the greatest progress in irrigation has been accomplished through the extension of the canal system.

This method also was used in ancient times, but some of the more important systems had fallen into disuse when the British took possession. Their construction requires heavy outlays of capital, and presupposes a stable form of government. The numerous legal complications which rise out of such an undertaking, and the relation of the Government to the land, together with the necessity of constructing certain systems having no remunerative financial value, have all led the British Government to take the system almost wholly in its own hands. The execution of this method requires a fairly level area. The methods used for the application vary in different localities. In the Madras Deltas, dams are constructed across the rivers at their entrance to the Delta region, and since their beds are almost on a level with the surface of the land, water is easily diverted into artificial channels. They yield their main supply during the annual flood period, and the region dependent upon them is therefore limited to one crop. In the Lower Punjab and Sindh the channel of the Indus River lies so far below the surface of the riparian country that its waters cannot easily be diverted by dams. Through the high banks deep cuts are made, and 'inundation canals' are constructed, which convey the water of the river during the flood period. By this means the land is watered sufficiently to produce one crop a year. The valleys of the Upper Ganges and Upper Indus are also too deep and broad to admit of damming, nor would the inundation system of the Lower Indus answer the purpose. Some of the crops commonly raised, and which require irrigation, grow in those seasons during which the rivers are at their lowest. For their irrigation, canals are dug so as to strike the rivers where they emerge from the mountains. The channels conduct the water along the water-shed of the plains, finally reuniting with the main streams. Some of these canals are notable both for their great length and capacity. Many of them are remarkable feats of engineering, owing to the difficulties surmounted in their construction, such as the crossing of other streams. Among the most famous of these are the Ganges Canal (q.v.), the Bari Doab Canal, which waters a large district to the northeast of Lahore, and the Western Jumna Canal, generally considered the oldest in India, which waters the region between the Sutlej and Jumna rivers, tributaries, respectively, of the Indus and Ganges rivers.

The following table shows the area in the different provinces irrigated during the years 1899-1900, the relative importance of the different sources of irrigation, and the proportion of irrigated land to the total crop area. It will be seen that the Punjab is the most, and Assam the least, dependent upon irrigation:

AREA IN ACRES UNDER IRRIGATION IN 1899–1900

ADMINISTRATIONS	Total area under crops	Area irrigated					
		By canals		By tanks	By wells	Other sources	Total area irrigated
		Government	Private				
Bengal	65,708,800	754,577	....	....	....	....	754,577
United Provinces of Agra	30,189,651	1,981,373	5,692	1,215,683	4,478,507	553,595	8,234,850
Oudh	11,413,508	....	....	976,394	1,643,178	80,453	2,700,025
Punjab	20,738,687	4,243,524	823,729	20,049	4,154,598	134,083	9,375,983
Lower Burma	6,665,639	310	1,325	....	....	3,434	5,069
Upper Burma	3,419,703	252,161	307,198	129,864	7,211	102,587	799,021
Central Provinces	17,043,937	....	810	176,187	64,188	14,079	255,264
Assam	5,321,818						
Ajmere-Merwara	394,844	....	....	7,228	43,776	116	51,120
Coorg	202,541	1,370	....	....	....	....	1,370
Madras	27,785,796	2,648,160	26,289	1,832,527	1,129,804	146,986	5,783,766
Bombay and Sindh	27,975,223	2,452,262	145,608	30,443	698,794	188,563	3,515,670
Berar	6,787,318	....	72	....	66,838	107	67,017
Pargana Manpur	6,868	....	....	....	324	....	324
Total	223,654,333	12,333,737	1,310,723	4,388,375	12,287,218	1,224,003	31,544,056

CROPS. In 1899-1900 the area actually cropped was 180,150,454 acres, and the current fallow 57,165,960 acres. The estimated area of the cultivable waste for the same year was 106,404,704 acres, besides which there were 135,506,014 acres not available for culture, and 65,843,924 acres under forest. The crop statistics for the year mentioned are given in the table on the next page.

The kind of crops grown is determined largely by the amount of the water-supply. In regions where the rainfall is excessive, or an abundant supply is readily obtainable, rice is almost the only crop. It is therefore confined largely to the Deltaic regions, and especially to the Bengal Delta. Here the annual overflow of the rivers makes irrigation easy. From the table below will be seen the great importance of rice in Bengal, Lower Burma, and Assam. The consumption of rice is not nearly so universal in India as is popularly supposed. It is not the cheapest food, and in many regions only the wealthy classes can afford it, while even in Bengal there are great numbers of the lowest classes who use but little. Sir William Hunter estimates that it is the staple food of less than one-third the total population of India. The main crop is reaped in the early winter—November to January—but in Bengal there is also a summer crop. Throughout the dry, non-irrigated portions of India millet is the commonest food crop, and is the largest item in the food of the lower classes over the greater part of the country, being most used in the southern districts. Practically the

CROPS, IN ACRES UNDER CULTIVATION IN 1899–1900 (ADD 000).

ADMINISTRATIONS	Rice	Wheat	Millets Jawar Bazra & Ragi	Other food grains, including pulse	Other food crops	Sugar-cane	Opium	Coffee	Tea	Cotton	Other fibres	Oil seeds	Indigo	Tobacco	Miscellaneous	Total area under crops	Area cropped more than once	Net area dealt with according to survey
Bengal	39,656	1,541	1,130	9,405	2,518	873	231	....	132	144	162	3,643	452	587	1,419	63,871	10,618	97,481
U. Provs. of Agra	4,592	4,601	3,506	11,443	393	1,023	220	....	8	968	69	516	212	38	767	28,864	4,461	50,874
Oudh	2,899	1,619	607	5,049	164	235	183	....	....	28	16	152	18	10	65	11,052	2,427	15,337
Punjab	482	5,488	1,259	3,844	595	361	4	....	10	735	30	493	74	67	1,547	14,993	2,017	65,811
Lower Burma	6,277	....	....	56	426	9	....	....	....	9	....	30	....	32	14	6,858	....	53,476
Upper Burma	1,818	15	804	337	132	2	....	....	1	153	....	527	1	38	124	3,958	260	47,849
Central Provinces	4,708	1,633	2,043	3,743	207	25	....	....	....	712	42	1,570	....	5	232	14,926	164	49,153
Assam	3,653	....	....	89	502	28	....	....	331	3	3	263	....	4	137	5,117	565	16,403
Ajmere-Merwara	....	1	93	104	2	....	....	....	....	35	....	8	....	....	2	248	17	910
Coorg	94	....	18	....	2	....	....	72	....	....	....	....	....	....	13	200	....	1,012
Madras	6,429	20	8,530	5,714	1,107	58	....	59	9	1,382	21	1,516	276	82	576	25,796	2,674	61,661
Bombay and Sindh	2,149	1,159	12,483	2,660	308	73	....	....	....	2,041	49	1,441	10	41	76	22,594	535	73,514
Berar	44	21	2,762	270	65	2	....	....	....	2,061	8	162	....	4	3	5,405	1	11,332
Pargana Manpur	....	1	2	2	....	....	....	....	....	....	....	600	....	....	....	6	....	38
Total*	72,809	16,104	33,243	42,721	6,426	2,693	640	132	493	8,375	404	10,327	1,046	915	4,981	203,895	23,745	544,858

* Jute and cinchona included in totals.

whole crop is used for domestic consumption, whereas rice is exported in large quantities. The planting and harvesting periods vary with different sections; in some regions two crops are raised, and in others, especially in the northwest, but one crop is produced, the rainfall being the controlling factor. The acreage shown in the table is somewhat less than the average for the decade.

After rice and millet pulse is the most important food product. In the United Provinces of Agra and Oudh it constitutes the largest crop. The figures in the table under the heading "Other food grains, including pulse," include gram, maize, and barley; the average each for the decade being approximately ten, five and one-half, and six million acres respectively.

Wheat is confined largely to the northwestern part of India, being the chief crop in the Punjab. It is a very important factor in the agriculture of the United Provinces of Agra and Oudh, and is produced to a less extent in the Central Provinces and Sindh. While there was formerly much apprehension in the United States that the wheat crop of India would drive that of the former from the world market, recent developments have not justified such fears, since the increase in area devoted to wheat in India was much less in the last fifteen years of the nineteenth century than in the preceding fifteen-year period. The wheat-producing area varies widely from year to year, the figures given in the table being over six million acres less than those for 1895. The average for the decade was a little less than 20,000,000 acres, about half of which is subject to irrigation. The average yield per acre varies with climatic conditions—in the Punjab it is about 13 bushels. The harvest occurs during April and May. Potatoes and other root crops are grown successfully, but they are not as favorite a food in India as in European countries. A large variety of tropical or semi-tropical fruits are grown for local consumption. The cocoanut is the most important export from the southwest coast. There are several kinds of dates having a local and commercial importance. Throughout India the raising of oil-seeds receives much attention, an average of about 12,000,000 acres being devoted to their cultivation. The product has been long an important item in local consumption, and in the last half of the nineteenth century large quantities were exported to Europe—the foreign demand giving an increased impetus to its cultivation.

Sugar-cane is grown in most provinces, but only in the United Provinces of Agra and Oudh and Bengal is it important. The crop requires irrigation and cultivation on a capitalistic scale, which tends to limit the development of the industry. The product has also to compete with the bounty-fed sugars from Austria-Hungary and other European countries, and although contravening duties are placed upon imports from these countries, they failed to prevent their importation. But the local product supplies much the greater part of the home consumption. In Southern India coffee is raised in Coorg, and southward in Madras. The industry enjoyed a period of development following 1860, but during recent years it has remained stationary. The culture of tea and that of opium owe their development to the fostering efforts of the Government. Tea culture was introduced about the middle of the nineteenth century, and has continued to increase to the present time. Requiring an abundance of water, it is best adapted to Assam and Lower Bengal, and is largely confined to these two regions, being grown for foreign markets rather than home consumption.

Opium is a Government monopoly, and its growth is restricted to certain regions, principally Behar, the country around Benares, and

Oudh. The poppy-plant, from which the opium is obtained, requires irrigation and careful attention. Most of the product is exported to China and the Straits Settlements. The area devoted to its culture does not vary greatly and increases slowly. Some tobacco is grown in most parts of the country for local consumption. About half of the total product is grown in Bengal, and part of it is exported. The tobacco is generally inferior to that grown in other countries, and therefore does not compete seriously in the European market. Indigo has ceased to hold its own, even in absolute importance. The acreage for 1900 was one-third less than that for 1895. The industry has suffered from competition with various substitutes, and with the product grown in Java. Bengal (particularly Behar), the United Provinces of Agra, and Madras lead in its production. Spices are raised and exported, but are of minor importance. The last half-century has witnessed a remarkable increase in the production of fibrous plants—cotton and jute.

Cotton had long been raised, but had not been drawn upon to supply the foreign market to any great extent until the Civil War in America stopped the supply from there. A reaction soon followed its rapid and extensive development, and though it subsequently increased again, it never regained the position held in the early seventies. During the last decade of the nineteenth century the area cultivated averaged about 9,000,000 acres. Cotton cultivation is not confined to any distinct region, but is relatively most important about the centre of the peninsula in Berar. The soil of this and the surrounding country is called the 'black cotton soil,' and is noted for the remarkable extent to which it holds moisture. The cotton is a short-staple grade, and therefore inferior to the American and Egyptian products. The production of jute is more restricted in extent, the plant growing best in the flooded lands along the Lower Ganges and Brahmaputra in Eastern Bengal. The average annual acreage for the last decade of the nineteenth century was over 2,000,000 acres. Like cotton, the product is largely exported, though there is not so large a per cent. of it that is exported in the raw state. A considerable part of the product is shipped to the United States. Silk culture is an important industry in the Punjab, Assam, and Lower Bengal.

The methods of cultivating crops in India are such as have prevailed for centuries. The natives show little inclination to take suggestions from the British. The efforts of the latter to accomplish results by means of experimental farms and the holding of fairs have not generally been successful. If better methods or superior kinds of seed, intended to secure greater results, are urged upon the farmer, he suspects the ulterior motive to be that of raising rents; nor is he very willing to show his stock at fairs unless he can secure a reward even if unmerited. But it is claimed that the native has adapted himself to the soil, and understands it better perhaps than his foreign instructors. If he does not plow deep the soil is such that it does not require it. The principle of the rotation of crops is known, though not widely practiced. Manures are utilized, but the necessity of using them as fuel in many places greatly limits their supply available for fertilizing.

Stock-raising. The above table of cultivated crops does not embrace fodder crops. These, however, are not important, as other Government tables show, a fact which suggests the unimportance of the stock-raising industry. During the decade ending with 1900 the area of the fodder crops varied from less than 2,000,000 to nearly 3,000,000 acres, showing some tendency to increase during the decade. A number of conditions are responsible for the undeveloped and unsatisfactory state of stock-raising. As is common in a tropical climate, the people are given almost wholly to a vegetable diet. Religious or caste prejudices prevent the greater portion of the Hindus from eating beef or pork. The period preceding the annual rains is characterized over a large portion of the country by a scarcity of both water and pasturage, and stock are generally reduced almost to starvation. This tends to make the breeds deteriorate. The disregard of proper methods in breeding has a similar influence. The grade of stock, therefore, is generally very inferior. Over the greater portion of British India cattle serve the same purpose that horses do in most countries. The breed of cattle is one that is unknown in this country, being of the humped variety. Buffaloes are also used as work-animals throughout almost all India. They are somewhat hardier than cattle and thrive in districts climatically unfavorable to the latter. Mules and donkeys are about equal in number to horses and ponies, the former being raised in the largest numbers in the Punjab and the latter in the United Provinces of Agra.

In the dry regions of the Lower Punjab and Sindh camels are the principal domesticated ani-

Live Stock in 1899–1900

PROVINCES	Cows, bulls and bullocks	Buffaloes	Young stock: calves and buffalo calves	Horses and ponies	Mules and donkeys	Sheep and goats	Camels
Bengal	2,076,500	431,600	246,200	35,900	12,700	616,400	30
United Provinces of Agra	11,613,400	2,979,200	6,408,300	434,400	262,700	4,943,300	11,300
Oudh	5,214,400	1,085,500	2,427,800	181,000	50,200	2,050,200	2,100
Punjab	8,197,700	2,495,200	3,712,600	312,700	612,300	9,901,900	271,000
Lower Burma	893,400	508,200	594,000	12,100	....	41,100	
Upper Burma	1,385,200	208,500	638,700	23,200	2,600	38,600	
Central Provinces	5,356,200	865,900	1,886,200	94,500	17,000	961,000	256
Assam	2,109,200	213,600	1,390,300	9,900	133	412,700	
Ajmere-Merwara	124,600	23,800	21,000	24,000	5,000	280,200	1,700
Coorg	61,300	19,621	19,100	400	300	2,400	
Madras	8,264,700	2,406,700	4,385,600	40,200	120,100	13,415,900	11
Bombay and Sindh	4,479,900	1,062,800	1,902,900	167,100	135,600	4,261,900	129,300
Berar	1,323,100	249,700	249,500	29,600	20,400	500,900	280
Pargana-Manpur	4,000	750	1.400	83	23	400	
Total	51,103,600	12,551,071	23,883,600	1,365,083	1,239,056	37,426,900	415,971

mals. In a few localities elephants are of great value in performing certain kinds of work, but their number and use are much more limited than is popularly supposed. The grazing industry is best represented in the raising of sheep and goats. These animals are valued chiefly for their wool. Some pigs are raised, but their number is not recorded in the Government reports. The preceding table shows the number of domestic animals by provinces for the year 1899-1900. Compared with the figures of a decade earlier a slight increase is found for almost every variety in most of the provinces.

FAMINES. From the earliest historical times India has suffered often and terribly from famines. There is much disagreement, however, in the matter of locating the responsibility among the different factors which have been held accountable for them. While famines are, of course, always preceded by local crop failure, almost every community is said to produce enough in ordinary times to bridge over the occasional period of scarcity, and it would appear that there has never been a year when the whole country did not produce enough food for all its inhabitants. Since crop failure always is at least the local cause of these awful experiences, it is worthy of first consideration. The general cause of crop failure is in the first instance a lack of sufficient moisture for the growing crops, though the period of insufficient crops may be extended because of the want of seed for a new crop, or of animals to till the soil. In limited districts floods sometimes destroy the crops, but the construction of embankments and canals has greatly lessened their destructiveness. In former years, under a less stable form of government, wars were not infrequent, and a shortage of crops and resultant famine ensued. But this factor has been much less conspicuous since the British control. In the paragraph above on climate will be found described the important natural elements which determine the distribution of moisture in India. It is only necessary here to note that there are districts in which the rainfall is always heavy—the chief of these being the region south of Bombay, the Deltaic region of the Ganges-Brahmaputra in the northeast, and Assam. There are other regions in which the rainfall is always very light, the largest being in Sindh and Rajputana. Throughout the remainder and most extensive portion of India the rainfall is subject to more or less uncertainty. In some portions, as in Upper Bengal and in Orissa, the fall is ordinarily heavy. In other regions, i.e. the upper valleys of the Ganges and Indus rivers, and throughout the Deccan and southeast coast—the precipitation is less constant, and failures of crops more frequent. The more densely populated districts, where the rainfall is abundant, are always ill prepared to meet a crop failure, and consequently suffer terribly when it comes. By means of irrigation works (see par. *Irrigation*) the extent of crop failure, however, has been greatly lessened over many parts of the country, especially where the rainfall is most uncertain and inadequate. Under British administration such works have even been extended into districts where the rainfall is usually sufficient. Irrigation itself sometimes fails, as in Madras, where the precipitation may not be great enough to supply the reservoirs or keep the streams full enough to supply the irrigation canals. Naturally the extent of the area affected by drought and the intensity of the distress and the frequency of occurrence vary greatly. The area may represent a third or more of the total population. The failure of a single season seldom, if ever, brings distress. It is when the second or sometimes the third failure occurs that relief is necessary.

It has been maintained that the destruction of the forests, which has been especially great in recent years, is not a little responsible for the droughts. A policy of reforestation therefore has been advocated, and steps have been taken to preserve the remaining forest areas. The fact that in districts adjacent to those where a famine may prevail a surplus of food crops is usually found, but cannot be transported owing to lack of facilities, has led the Government to construct railways, which would help greatly to solve the famine problem. The beneficial results, however, have been much disputed. The lack of rolling stock, for instance, has sometimes prevented the timely delivery of famine stores. A more serious accusation is that by bringing a district visited by famine in communication with the world's markets the district is annually drained of the surplus food which would otherwise remain in store for a year of scarcity. The main portion of the wheat crop of the Northwest is exported to Europe, though the natives may die of want before another crop is harvested. This criticism is part of a more general charge against the influence of the British Administration. The native, deprived of his manufacturing industries (see *Manufactures* in this article), and forced to purchase foreign products, as well as being obliged to pay a land tax which many claim is overburdensome, finds it impossible to retain any considerable portion of his produce. On the other hand, it is claimed that the native burdens himself with unnecessary debt; that he lacks thrift and is improvident. Before the British came it was more or less common for both private and public stores of grain to be kept from year to year; the latter were even required by law to be so kept. Latterly, however, the public stores, and to a large extent the private granaries, have disappeared.

The work of mitigating distress from famines has accordingly come to constitute a large part of the work of the British Government in India. Elaborate preliminary preparations are made in fear of their recurrence. The work is carefully systematized and officered. The country is districted, and in each district an examination is made of such matters as the water-supply, the social condition of the people, the probable extent of need in case of famine, and public works. The budget makes annual provision against famines whether they actually prevail or not. In the relief extended the Government policy aims at preventing death and at benefiting the individual. Wages are better for the individual than doles. Accordingly, the able-bodied man is given employment on public works, for which he is paid in money. The amount paid is much less than the normal wage, but sufficient to keep him in working condition. Provisions are supplied by the merchant, and the Government railway makes every effort to facilitate their transportation. For those not able to work hospitals and orphanages are prepared.

The public works are generally such as are considered of value in affording protection against a recurrence of famine. They are of two classes—those which facilitate transportation, and those which increase the water-supply. Special difficulty is always encountered in the administration of relief in any district, because there are not to be found local organizations whose purpose has been to deal with charitable problems, or individuals trained in the management of men and the superintendence of public works. Nor does the conscience of the native prove to be generally trustworthy. Public relief is not extended until the villagers begin to leave their homes and wander about the country in search of doles, usually toward a large centre of population, the profuse though indiscriminate village charity having been well-nigh exhausted. The people as a rule, especially the agriculturists, are very loath to abandon their homes. The mendicants and the day laborers are the first victims of distress and the first to quit the village. They are soon followed by artisans and agriculturists. The public works are usually many miles away, and the journey thither is likely to be exceptionally critical. At the public works the family unit is not destroyed. When all the members of the family are accustomed to labor outdoors at home they are fitted to work also on the public works. Artisans make or repair tools, weavers make clothing, and the assemblage becomes in many respects a normal community. When climatic conditions are again favorable the farmers especially are eager to return to their lands. And then the final, and ofttimes the most necessary, mission of the Government is to see that they are provided with seed, with cattle, and the necessaries for producing a crop.

The loss of life from starvation is sometimes considerable, but deaths from diseases which so frequently accompany the famine are generally greater. One of the most difficult tasks of the Government during the famine period is to enforce necessary sanitary regulations. However, taking one year with another for the whole country, the loss of life from famines constitutes but a small per cent. of the total death-rate. Their influence in reducing the population is greatly augmented through the very decided decrease in the birth-rate during the famine period. (See section on *Population.*) The ravages of disease in India are not peculiar alone to famine periods. The climatic and sanitary conditions give rise to pestilences which at intervals carry desolation over the country. Hospitals, richly endowed and admirably regulated, supported by Government as well as by private munificence, exist in all the large towns; and great efforts are constantly made to bring the benefits of medical skill and knowledge within reach of the poorer classes. In all parts of the country dispensaries have been opened where medicines are given out and patients advised. Disease in India is not a little due to bad water and bad drainage. Where a new water-supply has been introduced, and drains have been made, as in Calcutta, the improvement in the health of the inhabitants has been marked. Several millions of persons are vaccinated annually in India. Mortality is aggravated by the passion of the people for pilgrimages. All ages and both sexes each year traverse vast areas for their devotions, and die by hundreds on the route. The Mohammedan pilgrims go in numbers to Mecca, Kerbela, and Jerusalem, and a large proportion never return. The effort of the English to enforce sanitary regulations naturally meets with serious difficulties which grow out of the prejudices and customs of the people. Visits of the sanitary officers to the dwellings of the Mohammedans, as is sometimes necessary during the prevalence of a plague, occasion much complaint on the part of the natives.

MANUFACTURES. For centuries India has been noted for its beautiful fabrics and metal-work, made chiefly in the houses of the natives. They formerly constituted a large proportion of the exports of the country, and competed even with English goods until prohibitory laws were passed by Parliament to protect the British industry. Some Indian products, on account of the exquisiteness of the workmanship, occupy a class of their own, and have not been supplanted. But most native Indian industries are of a primitive type, and in a society so thoroughly impervious to the spirit of progress their modification and improvement have been impossible. Consequently the development of the factory system in England made it possible to manufacture products much more cheaply than could be done by the laborious methods of Indian workmen. In addition, recent improvements in transportation facilities have enabled European manufacturing centres to command a large part of the Indian market, with the result that in the home market in some localities, and in some outside markets, the Indian products have been almost entirely supplanted. The enormous growth of the imports of cotton manufactures is suggestive of the extent to which the native industry has been supplanted. For a further account of these movements, see paragraph on *Commerce.*

Large numbers of native workmen have thus been either thrown out of employment or forced to make a change of occupation, which was discountenanced by the prevailing social order. This has resulted in widespread poverty among the laboring classes and given occasion for one of the most serious charges against the alien administration. The National Indian Congress (see *Government*) has voiced the prevailing sentiment in numerous resolutions demanding a high tariff on imported manufactures in order to protect the home industry. Another emphatic demand is that the educational system of the country be altered so as to place more emphasis upon industrial training in order that rising generations may be better prepared to assist in the introduction of Western methods. (See section on *Education.*) Attempts to establish improved methods have generally depended upon foreign management and untrained native labor, besides having to contend with obstacles growing out of differences of caste. Of disadvantages growing out of a lack of material resources, the great want of fuel and the inferior quality of the coal are the most serious. Under these conditions the progress of improved methods of manufacturing is slow.

The most important manufacture is that of the coarser grades of cotton. The average number of hands employed in the cotton-mills increased gradually from 53,624 in 1883 to 112,000 in 1890 and 163,000 in 1900, while the number of mills increased from 62 in 1883 to 186 in 1900. About three-fourths of this industry centres in the city of Bombay. A similar increase was observed in the jute and hemp industry, which in

1900 employed 101,600 hands, as against 42,797 in 1883. It centres in the region about Calcutta. Among the other more important establishments are woolen, paper, flour, rice, oil, and lumber mills, the breweries, coffee-works and indigo and sugar factories. The total number of factories inspected under the Factories Act in 1899 was 1110, employing 360,000 men, 65,300 women, and 27,400 children. The provinces of Bombay and Madras each employed over a third of the total force. Among other manufactured Indian products are silk (including beautiful figured stuffs), various articles of luxury, such as highly wrought work in ivory, gold, silver, copper, and brass, cashmere shawls, etc. In weaving and in carving and inlaying wood and ivory, the native artisans are unsurpassed.

TRANSPORTATION AND COMMUNICATION. The network of railways to be seen on a map of India presents a decided contrast with the sparsity of railway lines in other parts of Asia. The mileage for British India is three-fifths the total for all Asia. The development of the railway system was prompted by a number of motives, and has been prolific and far-reaching in results. The military exigencies, development of the resources of the country, extension of British trade, and humanitarian sentiments or the desire to lessen the horrors of famine have each played varying parts in determining the location of lines and methods of administration. The results show that each of these efforts has been abundantly justified. Closely allied with the influence of the railway system as an economic factor has been its socializing influence—the beginning of the transformation of the native society, a lessening of the rigors of caste, and at least a portend of a reconstructed civilization along more modern and progressive lines.

Railway development in India has been in the main in harmony with a policy laid down as early as 1850 by Lord Dalhousie. This policy comprehended the construction throughout India of a system of grand trunk lines with a uniform gauge, connecting all the large centres of industry and population, and the construction of subsidiary or feeding lines with a narrower gauge and on a less expensive scale. The grand trunk lines were accordingly begun in the early fifties under a system of Government guarantee. The constructing companies were guaranteed 5 per cent. on the capital invested for a period of twenty-five years, and at the end of the contract period the Government had the right under specified conditions to take possession of the lines. The policy attracted capital to the country, and led to a more rapid railway construction than would have been secured by State construction. The guarantee, however, led to some extravagance in expenditure and became a heavy burden to the Government. A new policy accordingly was taken by the Government in 1863-64, under which assistance was advanced to new lines, which in turn obligated themselves to perform certain duties for the State.

A third policy was introduced in 1870 under which new lines were built and operated directly by the Government. The widespread and disastrous famines a few years later made it evident that new lines should be constructed faster than the Government could assume financial responsibility for their undertaking, and forced it to fall back upon private enterprise. New lines were built without regard to a uniform policy, the Government generally extending a guarantee, but for as brief a period as possible. Meanwhile the contract period of four companies had terminated, and new contracts were made for another twenty-five years, according to which the State, allowing certain concessions, was to share in the surplus income above 5 per cent. But subsequently, at the expiration of other contracts, the lines have been acquired by the State. Though no settled system has yet been adopted for the administration of railways, it will be seen that the greatest mileage is included in the lines belonging to the Government, but controlled by private companies. In 1900 a little less than half of the total mileage, or 11,654 miles, was represented by Government lines operated by companies; 1560 miles were owned by native States and operated by companies; 5884 miles represented State lines operated by the State; 1157 miles were owned and operated by the native States; 2663 miles were owned and operated by guaranteed companies; 1519 miles were owned and operated by assisted companies; 157 miles owned by the native States were operated by State Railway Agency; and there were 74 miles of foreign lines. The total mileage increased from 16,380 in 1890 to 24,668 in 1900. The total capital expended on Indian railways to the end of 1900 amounted to Rx. 332,751,083. Many of the lines net a large profit to the State, but these are more than counterbalanced by the more strictly military or famine-protecting roads, which result in an annual burden to the taxpayers of India, the amount fluctuating widely, but usually exceeding £1,000,000.

The number of post-offices in 1900 was 10,823, which was an increase of 29 per cent. during the last decade of the nineteenth century. The number of letters handled during the same period increased 60 per cent. The Imperial system of telegraph and the railway system have been united, and there is a uniformity of telegraph charges throughout the whole system, including 52,900 miles of line and 170,760 miles of wire (1900). The mileage of wire increased 50 per cent. in the last decade of the nineteenth century. There are three grades of messages—the urgent, ordinary, and deferred. The charges are less for the messages delivered with the less speed. For a period of ten years ending in 1899 the Government realized an annual average of 4.8 per cent. net revenue (based on the capital sum employed) after allowing for all working expenses.

COMMERCE. From the earliest periods of history India has held high rank in the trade of the world, having been a large producer of commodities that were highly prized in general commerce. The attempts of Portugal, Holland, and France to secure the largest share of India's trade form an important chapter not only of its own history, but of that of the world. The desire to find a short route thither by sea furnished much of the impetus given to the spirit of exploration during the fifteenth century, of which the achievement of Vasco da Gama (q.v.) affords a conspicuous example.

In 1600 an English trading company, the East India Company (q.v.), joined in the rivalry, and opened the way for the extension of English influence and power over the whole country. For over two centuries trade between England and India increased slowly. After the English East India Company was deprived of its monopoly in 1834 there began an epoch of rapid trade development. The abolition of the inland duties, the assumption of control by the English Government, the construction of the Suez Canal, and the improvement of inland transportation have been most influential factors in accelerating this trade movement. The magnitude of the increase since 1834, in which year the total foreign exports by sea were less than £10,000,000, is shown *pro tanto* by the following table:

Value of Foreign Imports and Exports by Sea, Excluding Government Stores and Treasures

	Imports			Exports		
	Merchandise	Treasure	Total	Merchandise	Treasure	Total
1869–1870	£32,879,000	£13,954,000	£46,838,000	£52,471,000	£1,025,000	£53,496,000
1889–1890	Rx. 66,560,000	Rx.17,459,000	Rx.84,019,000	Rx.103,396,000	Rx.1,841,000	Rx.105,237,000
1899–1900	£47,141,000	£13,972,000	£61,113,000	£72,650,000	£5,300,000	£77,950,000

The rate of increase has declined somewhat during the last decade. Since 1834, with few exceptions, the exports have annually exceeded the imports. A large proportion of the Indian foreign trade (about four-fifths of the imports and a little less than three-fifths of the exports) passes through the Suez Canal. Of this the greater share is with the United Kingdom. The figures for 1900 are: Imports via Suez Canal, £48,737,000, by other routes £12,376,000; exports via Suez Canal, £44,840,000, by other routes £33,110,000. The following table shows the amount of trade with other countries since 1869:

Value of Private Merchandise and Treasure Transported to and from British India by Sea

COUNTRIES	Imports			Exports		
	1869–70	1889–90	1899–1900	1869–70	1889–90	1899–1900
		Tens of Rupees			Tens of Rupees	
Europe	£31,353,100	67,403,500	£48,085,300	£33,123,200	64,628,700	£37,774,900
United Kingdom	30,324,900	62,504,100	40,803,300	27,798,700	39,581,000	22,473,200
Africa	884,100	2,575,700	2,192,600	772,100	6,937,100	5,774,100
Egypt	** 48,500	269,000	419,200	** 1,128	3,900 500	3,589,600
America	105,200	1,919,400	846,500	1,629,200	4,705,600	6,297,300
United States	†† 201,400	1,917,800	828,000	†1,506,900	3,768,700	5,079,633
Asia	13,719,800	10,979,100	7,886,800	17,919,500	27,895,000	27,037,170
*China	6,868,800	4,715,600	1,678,100	12,501,400	13,965,400	9,682,000
Australasia						
Australia, New Zealand, Tasmania	771,900	1,141;500	2,102,200	52,600	1,072,200	1,067 150

*Including Hong Kong and Treaty Ports. **1871–72.
†Western Hemisphere, not including West Indies. ††1875–76.

It will be noted in the above table that the preëminence of the United Kingdom in the trade with India is waning, particularly in the exports. They have been reduced to less than a third of the total exports, while the imports from Great Britain are almost two-thirds of the total imports. The increase in the exports from India has been largely in the exports to other Oriental countries. The United States is making significant gains in exports from India, but the amount of American products sent to India is still insignificant. The exports accredited to Egypt are probably intended largely for the Mediterranean trade. Among Continental European countries Germany, France, and Belgium are in the lead, the former being first in the amount of imports from India. In Asia the Straits Settlements and Ceylon have a large trade with India.

Two cities, Calcutta on the east and Bombay on the west, have the only good, large natural harbors on the coast, and about three-fourths of the entire trade passes through their ports; the former being more prominent in exports and the latter in imports. Adequate harbor facilities have been secured at great expense at Karachi, and it now serves as a port for the Indus Valley region. A harbor has only recently been completed at Madras and another at Rangoon—the port for the Irrawaddy Valley region.

The large increase in commerce during the last century has been accompanied by a radical change in the quality of the trade, and considered from this standpoint the increase has not meant a corresponding growth in the welfare of the country. A large proportion of the trade during the earlier period was in manufactured products, especially manufactures of metals and textiles. But the factories of Manchester and other foreign places have in a large measure supplanted the hand labor of India. Textiles, once an important export, now far exceed all other imports, and amount to over two-fifths of the total imports. The exports have become predominantly those of raw materials; the imports have become almost wholly manufactured products. As manufactured cotton leads in the imports, so raw cotton for a long time held first place among the exports. Cotton exportation received a great impetus during the Civil War in the United States, but it declined materially after the war, and has continued to do so ever since. Three or four other articles have surpassed it. Nearly all the cotton goods are imported from the United Kingdom, but that country receives only a small part of India's exports of raw cotton. The exports of India were formerly distributed among the European countries, but during the decade ending with 1900 the demand from Japan rapidly increased until it amounted to over half the total, or £3,730,000. The importation of cotton twist and yarn decreased one-half during the decade ending with 1900, and there was a corresponding increase in the exports of that article. These exports in 1900 amounted to £4,671,000, almost all going to China.

The other leading imported commodities, all having about equal rank, are hardware, machinery, iron, steel, and copper, mineral oil, railway plant and rolling stock, woolens, and sugar.

Great Britain has a practical monopoly for India in the supply of railway material and machinery, and it supplies also the larger part of other metal products, Belgium, of the other countries, sharing most extensively in the trade. Mineral oil is the principal import from the United States, but Russia now furnishes the bulk of this article. Among several exports of relatively great importance, rice—the only export upon which export duties are levied—is the most prominent and fluctuates the least, reaching an average value in recent years of about 13,000,000 tens of rupees. Most of the rice goes to Egypt, the United Kingdom, Ceylon, and the Straits Settlements. During the last quarter of a century there has been a great increase in the exports of oil seeds to Europe, averaging for the last decade nearly 11,000,000 tens of rupees. Exports of hides and skins, jute—raw and manufactured—and tea increased very rapidly during the decade ending with 1900, reaching in that year values of £6,975,000, £9,557,000, and £6,117,000 respectively. Raw hides and skins and jute cloth constitute the principal exports to the United States. The amount of each increased enormously during the decade and far exceeds that sent to any other country. Exports of manufactured jute increased 20 per cent. during the last decade of the nineteenth century. Nearly all the tea exported goes to the United Kingdom; it has not yet become a formidable competitor with the Chinese product for the United States markets.

Opium, which is exported to China and the Straits Settlements, is decreasing in amount, the total value for 1900 being £5,469,000. Exports of wheat fluctuate widely; the value for 1900, which was higher than the average for five years previously, was £2,606,000; the total for the last decade was much less than that for the preceding ten years. Most of the product goes to the United Kingdom. From 1890 to 1900, exports of indigo averaged about 4,000,000 tens of rupees annually, with a tendency latterly to decline. For more than two decades, ending with 1900, exports of coffee have varied from about 1,500,000 to 2,000,000 tens of rupees. Spices, which once were a large part of the exports, are now relatively insignificant. Treasure has long constituted one of the most valuable imports, and has annually exceeded in amount the exports of treasure for more than half a century. The value for the decade 1890-1900 averaged over 16,000,000 tens of rupees, over two-thirds of which was silver. Since the Government stopped the free coinage of rupees in 1893 the net imports of gold have been gaining upon those of silver. The exports of gold and silver for the same period averaged over 5,500,000 tens of rupees.

The imports and exports by land are not large, the totals for 1900 being respectively £4,700,000 and £3,759,000, which, however, constituted a considerable increase over the early years of the decade. Over half of the former and nearly half of the latter were to and from Nepal and Kashmir. The most important land imports were grain, pulse, timber, and provisions, while more than one-half the exports were cotton goods. Native craft carry on an extensive coastwise trade, particularly along the coast of Bombay. The traffic along this coast amounts to over one-third of the total coastwise trade. The large inland trade increases with the development of means of transportation. The inland and the local trade are very largely in the hands of natives, there being certain sects or castes, as the Parsis of Bombay, who devote themselves especially to this branch of industry.

The foreign trade of India is done mainly in British vessels, the tonnage of these in 1897-98 amounting to 89 per cent. of the total. This total was greater than that for the corresponding year of either of the two preceding decades. Germany and Austria-Hungary are the most important of the other nations represented.

GOVERNMENT. By an act of Parliament, which received the royal assent August 2, 1858, Queen Victoria was declared sovereign of India, and various regulations were enacted for the better government of the country. In 1877, in virtue of an act of Parliament, passed in 1876, the Queen was proclaimed Empress of India. The Home Government of India is vested in a Secretary of State, who is a member of the English Cabinet. He is assisted by an Under-Secretary and a council of fifteen members. The Indian Executive Government is administered by a Viceroy or Governor-General, appointed by the Crown, and acting under the control of the Secretary of State for India. The Viceroy's term of office is for six years, and he is assisted by a council of five ordinary members, three appointed by the Secretary of State, and two by his Majesty's warrant. Each of them has charge of a department of the executive. The Viceroy himself retains the oversight of foreign affairs, and can overrule a majority vote of his council. The commander-in-chief is an extraordinary member of the council. This council, whenever it acts as a legislative body, is enlarged. It then has from ten to sixteen additional members who are nominated by the Viceroy for terms of two years, half of them being non-officials. Five of these councilors must be individuals who have been recommended, one each respectively by the unofficial members of the councils of Madras, Bombay, Bengal, and the United Provinces of Agra, and one by the Calcutta Chamber of Commerce. Proposals to legislate upon subjects such as finance, religion, military and naval forces, or the relations of the Government with foreign princes or States, must first receive the sanction of the Governor-General.

For purposes of administration, British India is separated into a number of divisions or provinces. They differ in the method of their government. The two governments of Madras and Bombay are under the rule of Governors appointed by the Crown, and assisted by legislative and executive councils. The executive council consists of only two men. From eight to twenty others are added to form the legislative council. These bodies communicate only with regard to important matters with the Home Government through the Governor-General. As regards affairs of minor importance, they correspond directly with the Secretary of State for India. The Provinces of Bengal, the United Provinces of Agra and Oudh, the Punjab, and Burma are administered by Lieutenant-Governors appointed by the Governor-General, subject to the approbation of the Secretary of State for India. These officers act without the aid of any executive councils, but have legislative councils of not more than twenty members, nominated by the Lieutenant-Governor on the approval of the Governor-General. There are a number of points upon which the local legislators in India cannot touch, and their proceedings are void if disapproved by the Governor or Lieutenant-Governor, the Governor-General, or by the Home Government. The following divisions, viz.: Assam, Central Provinces, Berar, Ajmere-Merwara, Coorg, British Baluchistan, the Andaman Islands, and the new Northwest Frontier Province, are under chief commissioners. There are no local councils for these provinces, such legislation as they may need being supplied by the Governor-General in legislative council. All the foregoing governmental divisions are subdivided into smaller divisions called districts, of which there are in all 250, varying both in size and population. The executive officer in each district is called the collector magistrate or deputy commissioner. This office is remarkable in that its powers extend over every department of administration. The officer has charge of the collecting of the revenue, of education, roads, sanitation, police, and jails, and he is judge both of first instance and of appeals.

It has been the policy of the British Government to try to awaken a sense of civic responsibility among the natives, and it has encouraged the creation of the necessary machinery for local self-government. Much difficulty has attended the effort, owing to the absolute dominance which class distinction holds over the social order, making almost impossible the development of the idea of a mutual community interest. Some progress, nevertheless, is being made. Every province of India has since 1860 secured laws which place the administration of municipal affairs in the hands of local bodies. In small places these bodies are nominated from among the townsfolk, but in large places they are mostly elected. Under specified regulations, the local bodies may raise funds or receive grants of public money for local purposes. In 1901 there were 764 of these municipal towns, containing an aggregate population of 16,500,000. The total income of these towns for the year mentioned was £4,828,288. The rural regions have also been supplied with district and local boards for purposes of self-government. In 1901 there were 1101 of these boards, including a total of 5553 elected members and 10,661 ex-official and nominated members. The income of these rural regions for the year mentioned was £2,509,829. The probability of the development of a national representative native government is scarcely conceivable. The idea of a common country or a national life does not exist. The masses are ignorant of even the geographical conception implied in the name India. There is, it is true, a national native Congress, which meets annually, but it is scarcely representative in any true sense or indicative of any popular national tendencies.

There are high courts of jurisdiction at Calcutta, Madras, Allahabad, and Bombay, appointments being made to them by the Home Government. These courts have a general oversight of the lower courts and are courts of appeal, but there is an ultimate appeal to the judicial committee of the Privy Council in England. The Punjab has a chief court, and the Central Provinces, Oudh, and Mysore have each a judicial commissioner. Burma has two judicial commissioners, as well as a recorder. The great majority of the magistrates in the courts of original jurisdiction and of the civil judges are natives. Europeans have certain privileges in court not possessed by natives.

Finance. In the consideration of Indian finance, regard must be given to the denomination in which the estimates are made. If estimated in pounds, as in the following table, there is an apparent decrease in most of the noncommercial items of revenue and expenditure. On the contrary, if estimated in rupees, most of them show a very decided increase. The depreciation in the value of the rupee, as measured in gold, accounts for this difference; but since the burden upon the taxpayer is determined by the local purchasing power of the rupee, the question of the effect upon the welfare of the native is a subject of dispute.

Leaving out of account the productive enterprises of the Government, which are largely self-supporting, it will be seen that customs and excise play a minor part in the support of the Government, while land revenue has contributed on an average considerably over a fourth of the total amount. The stamp, salt, and opium revenues also play a conspicuous part. The land revenue, however, is not absolutely nor relatively so important as formerly. This revenue partakes of the nature of a rent as well as of a tax. The rent varies with soil and the distance from the town, but averages about 1s. 10d. per acre for the total acreage of cultivated land. The opium revenues are secured mainly from the monopoly of the industry in Eastern India, and the export duty collected in Western India. An increase in the salt duties in 1888 established the present uniform rate of 2½ rupees per maund. The collections from stamps are principally obtained from court fee stamps. The largest item in the excise revenue is that collected from the manufacturer of spirits, but other sources, as, for instance, the monopolies for the sale of liquors and intoxicating drugs, help to swell the amount. The interests of British trade have determined the policy of keeping the import duties—especially those on cotton goods—at a minimum figure, though the natives have at the same time demanded tariff protection. The general customs duties of 5 per cent. existing prior to 1882 were abolished in that year, except those on salt, opium, wine, beer, spirits, and arms. In 1894 a 5 per cent. ad valorem was reimposed, except on machinery and a few other articles; but two years later the duty on woven cotton goods was reduced to 3½ per cent. ad valorem, and cotton yarn was exempted from duty. Since 1886 an income tax has been assessed upon incomes exceeding 500 rupees.

In the last two decades of the nineteenth century the budget yielded a surplus for twelve years of the period, and showed a deficit for eight years. The heaviest drain upon the Imperial Exchequer is made by the military charges. They are followed closely by the cost of the civil service. Both of these items, according to the consensus of native opinion, are unnecessarily burdensome upon the country. The army charges are irritating because the natives consider the army too large, and particularly because of the large proportion of British soldiers who monopolize most of the best positions, and whose salary and pensions are largely taken or sent out of the country. The Civil Service excites native criticism because of the practical monopoly exercised by the English over the higher offices, and the excessive salaries attached to them. A few English officers receive an aggregate remuneration considerably greater than that given to the numerous native minor officials. The control of the opium, customs, post-office and telegraph, tributes, mint and currency, receipts and the expenditure under the heads of army and military works, political relations, public debt, and certain trunk railways, is retained by the Central Government. The management of all provincial revenues and some of the Imperial revenues is delegated to the local governments.

The following table gives a statement of the average annual expenditure for the two decades indicated and the year 1901:

DETAILS	1881–90	1891–1900	1901
Direct demand on revenue	£9,198,111	£6,797,206	£7,552,341
Interest	4,600,546	2,480,488	2,138,946
Salaries and expenses of civil service	12,277,556	9,916,049	10,971,622
Miscellaneous civil charges	4,597,045	4,441,431	3,987,370
Famine relief and insurance (excluding charges on account of protective railways)	931,379	1,141,481	4,156,344
Buildings and roads	5,279,111	3,862,520	4,068,721
Army services	19,484,591	15,585,835	15,082,799
Special defense works	275,255	152,685	6,864
Construction of railways (charged against Revenue in addition to that of Famine Insurance)	199,942	41,373	
Post-office, telegraph, and mint	2,126,871	1,736,072	5,157,660
Railway revenue account	14,953,786	14,487,566	17,968,505
Irrigation	2,380,082	2,025,011	2,320,327

The total average in round numbers for each decade is, respectively, £76,300,000 and £62,600,000. The total for 1901 is £73,400,000.

The following table shows the average annual revenues for each of the three decades indicated and for the year 1901:

DETAILS	1871–80	1881–90	1891–1900	1901
Land revenue	£21,100,759	£22,496,636	£16,869,344	£17,503,031
Opium	8,936,068	9,176,138	4,591,820	5,102,242
Salt	6,383,315	6,885,891	5,764,241	5,967,034
Stamps	2,802,489	3,643,720	3,063,493	3,342,948
Excise	2,463,086	4,088,004	3,638,876	3,937,202
Customs	2,558,202	1,504,890	2,283,491	3,371,597
Interest	520,793	792,203	608,327	651,479
Receipts by civil departments	981,740	1,468,413	1,115,376	1,243,076
Miscellaneous	457,045	1,076,186	525,298	529,492
Building and roads	....	605,741	447,953	458,470
Receipts by military departments	....	1,762,080	603,187	817,274
Provincial rates	575,946	2,948,487	2,426,251	2,562,713
Assessed taxes	527,345	905,669	1,198,645	1,322,094
Forest	594,910	1,071,281	1,115,425	1,297,863
Tributes from native States	720,079	721,006	552,748	577,823
Registration	....	300,133	284,843	312,558
Post-office, telegraph, and mint	1,278,055	1,911,061	1,951,095	5,425,847
Railways	2,519,049	12,997,363	13,922,181	18,293,629
Irrigation	552,189	1,677,791	1,838,804	2,555,919

The total average for the decade 1871-80 was £55,000,000; for 1881-90, £75,000,000; and for 1891-1900, £62,800,000. The total for the year 1901 was £75,200,000.

Debt. The permanent debt of India gradually increased from £33,577,414 in 1842 to £51,327,958 in 1857, when it rapidly grew in consequence of the Indian mutiny, and stood in 1862 at £97,037,062, and gradually increased to £205,323,315 in 1901. Of this last amount, £76,887,936 was held in India and £128,435,379 in England. The greater part of the debt in India bears interest at the rate of 3½ per cent., and about one-half the debt in England bears interest at the same rate, the remainder paying interest at the rate of 3, 3¼, and 2½ per cent. Besides the above there were an unfunded debt in England of £5,000,000, and other obligations assumed in India for savings banks, departmental and judicial deposits, etc., which brought the total liabilities up to £223,843,244 in 1901. The total interest for that year, amounting to £7,436,973, was distributed as follows: Railways, £4,376,699; irrigation, £921,328; ordinary debt, £1,776,406; and other obligations, £362,540.

Currency. In British India accounts are kept in rupees, annas, and pies—16 annas making one rupee, and 12 pies making one anna. Beginning with the early seventies the rupee was subject to great fluctuation in value, with a general downward tendency. The burden of taxation was greatly increased in consequence of the great fall in the value of silver, the Indian revenues being raised in silver, while the amount spent in Great Britain on account of India was paid in gold. This sum is disbursed in the payment of fixed charges, such as salaries and pensions of civil and military officers. The difference between the exchange value and the market value of the rupee became so great that the number of rupees raised by the Government had to be increased by one-half. The financial embarrassment thus caused led the Government in 1892, when the exchange value of the rupee sank to 1s. 1d., to consider a plan for the closing of the Indian mints to the coining of silver. In June, 1893, a law to this effect was passed, and the rate of 1s. 4d. for the rupee was established as the gold price of silver, provision being made that when the rupee rose to this value the mints should be reopened to the coinage of silver. The value of the rupee gradually rose, and, so far as the Government was concerned, the financial conditions greatly improved. But complaint was made that the native growers and the European planters in India were suffering severely from the change. It was argued that these classes were obliged to pay labor on the old scale, in spite of the appreciation of the currency. Hence, while industrial expenses remained nominally the same, the employers received lower profits. Heavy losses fell also upon the natives, who as times grew hard were obliged to turn their hoards of silver into money. Finally, in the spring of 1898, a currency committee was appointed to investigate the monetary situation in India. This committee reported, in July, 1899, in favor of maintaining the gold standard, and making it more effective; and to this end a law was passed in September of the same year. Since 1899 the value of the silver rupee has been stable at the rate fixed—1s. 4d. (32.4 cents). The coinage of rupees, which for some years after 1893 almost ceased, became large in 1900-1901, and the profit on the coinage was set aside as a special gold reserve fund to be used in maintaining the rate of exchange between Great Britain and India. There is a comparatively small amount of paper money in circulation in India. It is legal tender within certain limited districts. The amount outstanding in March, 1898, was 298,659,000 rupees, about two-thirds of which was in the districts of Calcutta and Bombay.

According to the Indian money system, 100,000 rupees equal 1 lakh, and 100 lakhs equal 1 crore. Hence a sum that would be read in terms of rupees only, according to the English method, would, according to the Indian method, be differently punctuated and read in terms of both the larger and the smaller denominations. To illustrate: The sum 37884517000 rupees would in English read 37,884,517,000 rupees, but in the Indian notation it would be written 3,788,45,17,000 and read "Three thousand seven hundred eighty-eight crores, forty-five lakhs, seventeen thousand rupees." In Indian money estimates, sums are often given in tens of rupees, the abbreviation being Rx.

Civil Service. The administrative offices are largely filled through civil service appointments. Candidates taking the examination required to secure a position must be under twenty-four years of age. The successful candidate is then on probation for a year in England, during which period certain requirements are to be fulfilled, as, for instance, the learning of the Indian law. A pension is obtainable after twenty-five years of service. Advancement is secured partly by promotion and partly by seniority. After a probationary period of four years a selection may be made between the revenue and the judicial departments, the civilian remaining in the department selected throughout the remainder of his career in the service. There are about 1000 positions to be filled under the covenanted civil service of India. Inasmuch as the examinations are held in London, there are not many natives of India who are able to take them, and nearly all the highly paid positions still go to Englishmen. However, the minor administration, both administrative and judicial, is mostly filled by natives. It is estimated that 90 per cent. of the civil employees of India are natives.

Defense. The supremacy of the British sea power practically guarantees India from invasion by way of the sea, and the Himalaya Mountains perform a like service for a great part of the northern frontier. The main interest in the defense of India centres about the northwest frontier, which is the historic gateway for invasions into India. In the last two decades of the nineteenth century the British adopted a more active frontier policy. They have established outposts and fortifications commanding the mountain passes that communicate with the west and north and more securely defend the Trans-Indus region. The British have a post of observation at Chitral and possess an 'influence' at Gilgit which enables them to keep informed as to the Hindu-Kush passes. Farther south the Swat Valley is in the hands of the British. The important Khyber Pass (q.v.) is open, and the large garrison stationed at Peshawar serves to protect it. Continuing south, the Kuram and the Tochi valleys are controlled by the British, as are also the Gunal Pass and the Zhob Valley. Quetta has been made a strong defensive point, as has also Sakkar—the city on the Indus where the railroad crosses to the westward. A number of posts along the earlier frontier line farther east are still maintained; others have been abandoned. The scheme of defense has led to the construction of railroads for military purposes, one of which extends to New Chaman, the farthest outpost on the Afghan frontier. These lines now make it possible quickly and easily to transport the soldiers to the different frontier strongholds.

The threatening approach of the Russians to the Indian frontier has established an excuse for the British to maintain a large army. The experience of the Sepoy rebellion has led them to increase the proportion which the British troops hold to the total military force, the intention being that the latter shall constitute one-third of the total number, and that the artillery shall be almost wholly British. The native soldiers are drawn largely from a few tribes, such as the Sikhs, Gurkhas, Rajputs, and Jats, who are the warrior races of the country, and are much more efficient as soldiers than are the masses of the population. Class distinctions are recognized, and the different units in the army organization are composed of homogeneous elements. Through the improvement of sanitary conditions, and the exercise of greater caution in locating British soldiers, fatalities are of much less frequent occurrence than formerly. The native States still maintain military forces, but the British have succeeded in their effort to have their number reduced and brought more or less under their own control. For a statement concerning the organization and statistics of the army, see Armies, paragraph on *British Empire*.

Weights and Measures. The unit of weight commonly used is the maund, but it varies greatly in amount, being equivalent to 82¾ pounds avoirdupois in Bengal, only about 28 pounds in Bombay, and 25 pounds in Madras. The tola, a small unit, is equivalent to 180 grains. In Bengal there is a unit of measure called the guz, equivalent to 36 inches. An act was passed in 1871 to establish a uniform decimal system of weights and measures, but it has never gone into operation.

Population. India is one of the most densely populated countries, containing between one-fifth and one-sixth of the estimated population of the world. In 1901 the number of inhabitants per square mile was 188, as against 283 (estimated) for China, and 25.6 (1900) for the United States. The population is most unevenly distributed, nearly two-fifths being found in the valley of the

Ganges. As shown in the table, the density is greatest in the Province of Bengal. In the Patna division of Bengal, an area of 23,686 square miles, the density is 653 per square mile. The density of the population corresponds in a general way to the capacity of the different regions to support life, yet there are noteworthy exceptions, as in Assam and Lower Burma, each of which could easily support a much more numerous population than it now does. In most districts the population presses closely upon the limits of the means of subsistence, and cannot increase greatly so long as agriculture continues to be almost the sole dependence. There has been generally an increase and in many places a very marked increase of population since the British took possession. Prior to that time numerous wars, together with famine, plague, and pestilence, tended to check augmentation. The instability of the Government discouraged industrial enterprise, and much land possible to cultivate was left waste. Under British protection such land has been largely reclaimed, and the productive capacity of the country greatly increased. So long as an area of cultivation was being extended the local population augmented. When the limits of culture were reached the population became overcrowded and finally reached a stationary point. In most instances the growth of the population depends almost wholly upon the natural increase in the district, immigration from remote localities playing a very minor part. The people dislike to leave their native locality, and particularly dislike to embark upon sea voyages. The most considerable movement has been that from Bengal into Assam. Another movement of some importance has been from Madras into Burma and Ceylon.

The first attempt of the British to secure a complete census was made in 1872, when the total population was estimated to be 240,931,000. The returns for certain regions were only estimated, and were generally rendered uncertain through the lack of confidence on the part of the natives in the purpose of the Government. In subsequent enumerations there have been greater confidence on the part of the people and a corresponding increase in the accuracy of the returns. The total population for 1891 was 287,314,671, and for 1901, 294,360,356. It should be remembered that certain additions of territory have augmented slightly this increase. The gain during the decade 1881-91 was 10.96 per cent. as against an increase of 1.49 per cent. for the same area in the following decade, or an increase for the latter decade of 2.4 per cent., including the population of the new territory added. In the former decade 94.6 per cent. of the population showed an increase, whereas in the latter period only 63.3 per cent. showed an increase. The gain in the provinces of the last decade was 3.87 per cent.; the population of the native States decreased 6.30 per cent. The contrast shown above between one period and the other, and between one region and another, is largely attributable to the variable agricultural conditions. The earlier period suffered little from famines, the latter excessively. The decrease was greatest in Central and Western India, where the famine was most severe.

The following is a table of the area and population of India and its dependencies:

	Area in square miles	1901	1891
Provinces (*Total*)....	1,106,861	231,898,807	221,239,515
Ajmere-Merwara...	2,711	476,912	542,358
Andamans and Nicobars	3,188	24,649	15,609
Assam	56,243	6,126,343	5,477,302
Baluchistan (Districts and Administered Territories)	45,804	308,246	
Bengal	151,185	74,744,866	71.346,961
Berar.............	17,710	2,754,016	2,897,491
Bombay..........	75,918	15,304,677	15,959,135
Sindh	47 066	3,210,910	2,875,100
Aden	80	43,974	44,079
Burma	256,195	10,489,924	7,722,053
Central Provinces ..	86,614	9,876,646	10,784,294
Coorg	1,582	180,607	173,055
Madras............	141,726	38,209,436	35,630,440
Northwest Frontier Province	16,466	2,125,480	1,857,504
Punjab............	97,209	20,330,339	19,009,343
United Provinces of Agra (formerly Northwest Provinces)	83,198	34,858,705	34,253,960
Oudh	23,966	12,833,077	12,650,831
Native States and Agencies * (*Total*).	679,393	62,461,549	66,075,156
Baluchistan Agency	86,511	502,500	
Baroda State.......	8,099	1,952,692	2,415,396
Bengal States	38,652	3,748,544	3,326,837
Bombay States	65,761	6,908,648	8,082,107
Central India Agency..........	78,772	8,628,781	10,318,812
Central Provinces States	29,435	1,996,383	2,160,511
Hyderabad State ..	82,698	11,141,142	11,537,040
Kashmir State	80,900	2,905,578	2,543,952
Madras States	9,969	4,188,086	3,700,622
Mysore State	29,444	5,539,399	4,943,604
Punjab States	36,532	4,424,398	4,263,280
Rajputana Agency .	127,541	9,723,301	11,990,504
United Provinces States (formerly N. W. Provinces).	5,079	802,097	792,491
Grand Total...........	1,786,254	294,360,356	287,314,671

* See article INDIA, NATIVE STATES OF.

To this should be added some territories in India not included in the census, with an area of about 73,000 square miles and a population estimated at about 700,000. Aden, on the Arabian coast, with an Arabian protectorate embracing 15,500 square miles, and Socotra, a dependency of Aden, are officially included within the Empire of India. With these additions the total area of India and its dependencies is about 1,860,000 square miles.

A striking characteristic of the population is that it is so largely rural. Estimates show that about nine-tenths of the total belong to this class. This is true of even the most densely populated regions. The largest city in the densely populated division above referred to (Patna) has but 135,000 inhabitants. It must be understood, however, that the rural population is everywhere gathered together in villages which may contain only a few families or may number thousands. The country had not many large cities until the period of commercial development brought about by the British. Commerce has occasioned an immense growth in Calcutta and Bombay, but except these cities Madras alone exceeds half a million. (See table below.) Another peculiarity is the large proportion of males compared with European countries. The great privacy to which the females are subjected, particularly among the Mohammedans, and the aversion to intrusion on their domestic privacy, may serve partly to account for this discrepancy. Statistics for famine districts show that in these regions there is a greater decrease in the male population than the female. It is generally accepted that women withstand the deprivations of the famine more successfully than men.

Population of the Largest Cities (Including in Most Cases Cantonments)

	Total Population in	
	1901	1891
Calcutta and Fort	847,796	682,305
Bombay City	776,006	821,764
Madras	509,346	452,518
Hyderabad	448,466	415,039
Lucknow	264,049	273,028
Rangoon	234,881	180,324
Benares	209,331	219,467
Delhi	208,575	192,579
Lahore	202,964	176,854
Cawnpore	197,170	188,712
Agra	188,022	168,662
Mandalay	183,816	188,815
Allahabad	172,032	175,246
Amritsar	162,548	136,766
Jaipur	160,167	158,787
Bangalore	159,046	180,366
Poona	153,320	161,390
Patna	134,785	165,192

Education. Education on the part of England in India has been carried on in the face of many serious obstacles, and under complex conditions peculiar to the country. Social, religious, and racial distinctions, solidified in the system of caste, were so thoroughly interwoven with the whole of the life that they circumscribed the scope and modified the methods of English instruction. British education has never had to deal in India with the implanting of Western culture on an Oriental people having no culture of their own, but the superimposing of one system of culture upon another more philosophically profound in its sphere, and upon a people who cherished an educational lore that antedated by far the one offered them in its stead. A system of education such as it was and restricted to the sanctioned castes—chiefly the Brahmin—had never been wanting in India. When the English began to introduce the new system, a bitter dispute arose as to how much recognition should be given this ancient and native learning; for instance, whether the English classics should supplant the Sanskrit and Arabic, and whether the English or the vernacular should be used as a medium of instruction. These questions were finally decided in favor of European as against Oriental knowledge, and in favor of the vernacular as a medium, though English became prominent in advanced instruction, and generous provisions were made to bring it within reach of all who desired it.

This system, which was finally adopted, and which in the main continues to-day, was outlined by Lord Halifax in 1854. An investigating commission, reporting in 1883, approved the system, but favored emphasizing certain features, such as the encouragement of native schools and of primary and female education, to the end that the masses might share more liberally in the benefits of learning. Religious instruction has never been permitted in the State schools—a policy different from that pursued by the English Government in the schools of England, and which has generally been opposed by the clerical and missionary interests. At the same time the State advances financial aid to missionary schools without discrimination as to sect, and endeavors to avoid competition with them by not establishing schools where the missionary schools already provide adequate facilities. Both missionary and State schools are under the supervision of State inspectors, and must conform to certain regulations. Grants in aid consist of salary grants, results' grants, building grants, etc. The State educational system is complete in scope, including primary, secondary, and collegiate instruction, and is systematically organized and administered. Normal schools are maintained in every province. There are five universities—Calcutta, Madras, Bombay, the Punjab, and Allahabad. They consist of examining bodies only, but have a large number of affiliated colleges. The number of persons receiving instruction has greatly increased during the past half-century. The field of education is, however, limited. The attendance is largely from the middle classes, especially in the State schools, and while the missionaries reach a larger proportion from the lower castes, the entire number is small in comparison with the number of persons to whom opportunities for education never come.

Two criticisms in particular have been urged against the present system. The first is, the relative over-emphasis of higher education. This emphasis has been in accordance with the 'filtering down theory,' under which it was thought that the masses could be reached best through the agency of a highly educated native class. This theory in practice, however, leaves the masses untouched. The other criticism is that too much attention is given to classical and not enough to industrial instruction, and that, accordingly, the pupils are not fitted to take an active part in the industrial transformation which the country needs.

The figures taken from the last quinquennial review, reporting in 1897, show that there were 1,236,000 pupils in the State schools, 2,019,000 in aided schools, 532,000 in unaided schools, and 568,000 in private schools. Of these only 402,000 were females, or 2.3 per cent. of all the females of school age in India, the male attendance being 22.3 per cent. of all males of school age. The percentage of boys in attendance varied from 38.8 per cent. in the Province of Burma to 9.3 per cent. in the United Provinces of Agra and Oudh. The grand total of all pupils in public and private institutions increased during the decade 1890 to 1900 from 3,692,000 to 4,462,000. Native Christian pupils represented 5.16 per cent., Hindu 72.86 per cent., and Mohammedan 14.62 per cent. of the total attendance. In public institutions there were 97 per cent. of the pupils studying the vernacular language; the percentage of those studying the classical languages and the English language was small. Over a third of the proceeds used for education was derived from fees, the remainder being divided between provincial, local, and municipal funds and other sources. The total expenditure on public instruction increased gradually from 3,31,58,447 rupees in 1894-95 to 3,77,29,012 in 1899-1900.

RELIGION.

From the earliest times India has been a land of numerous religions, and the creeds professed there to-day are almost as great in number as they are varied in spirit and character. The majority of the people acknowledge Hinduism or Brahmanism (q.v.) as their faith. In the census of 1901 their number is given as over 200,000,000. Next in proportion, claiming about a third of this number, is Mohammedanism, which was introduced into India in the eleventh century, and spread with great rapidity. Its adherents claim no less than 60,000,000 souls throughout India, their numbers being largest in the north. Together these religions make up the faith of 90 per cent. of the entire population. The number of Buddhists is given at over 9,000,000; they are nearly all inhabitants of Burma. Statistics show that the number of nature-worshipers, who are roughly classed under the head of animistic, is no less than 8,500,000; while the Sikh religion is professed by over 2,000,000 individuals. Besides these there is a large representation of Jains, over 1,000,000, and a scattering number of Parsis, nearly 100,000. The spread of Christianity among the natives has been considerable, for the number is given at about 3,000,000 souls. There are nearly 200,000 Jews. Separate articles will be found devoted to the most important branches of Indian religions. (See BRAHMANISM; BUDDHISM; JAINISM; MOHAMMEDANISM; PARSIS; SIKHS.) The results of the religious survey of India in the census of 1901 present the following statistics. The first table is itemized by provinces for British India, with totals for native States and agencies. The second is the summary of the Christian population:

ADMINISTRATIONS, PROVINCES	Population and Religion								
	Hindus	Sikhs	Jains	Buddhists	Parsis	Mohammedans	Christians	Animistics	Total
Ajmere-Merwara	380,819	264	19,922	....	164	72,031	3,712	....	476,912
Andamans and Nicobars	9,264	370	61	1,860	2	4,207	486	8,399	24,649
Assam	3,429,459	505	1,797	8,911	3	1,581,317	35,969	1,068,334	6,126,295
Baluchistan	21,897	2,947	8	....	166	279,154	4,026	....	308,198
Bengal	46,740,661	328	7,457	210,628	388	25,265,342	275,125	2,242,770	74,742,699
Berar	2,388,016	1,449	19,639	....	530	212,040	2,375	129,964	2,754,013
Bombay	14,200,047	1,122	227,696	547	76,009	3,760,175	208,930	69,930	18,544,456
Burma	284,880	6,525	93	9,184,112	245	339,430	147,525	399,390	10,362,200
Central Provinces	8,171,925	477	47,306	169	969	295,291	24,809	1,835,573	9,876,519
Coorg	159,817	....	107	....	41	13,654	3,683	3,305	180,607
Madras	34,048,097	92	27,431	243	356	2,467,351	1,024,071	641,730	38,209,371
North Western Frontier Province	134,252	28,091	87	....	46	1,957,777	5,273	....	2,125,476
Punjab	7,874,413	1,517,019	42,745	4,182	445	10,825,698	65,811	....	20,330,313
United Provs. of Agra and Oudh	40,757,137	15,319	84,401	788	578	6,731,034	102,469	....	47,691,726
Total Provinces	158,600,684	1,574,508	478,700	9,411,440	79,942	53,804,501	1,904,264	5,899,395	231,758,434
Total States and Agencies	48,545,738	620,760	855,448	65,310	14,248	8,653,560	1,018,977	2,684,954	62,458,995
Total all India	207,146,422	2,195,268	1,334,148	9,476,750	94,190	62,458,061	2,923,241	8,584,349	*294,212,429

* Jews numbering 18,228, and minor sects numbering 2,686 are not included in this table.

CHRISTIANS ACCORDING TO RACE AND DENOMINATION FOR ALL INDIA

	Church of England	Presbyterian	Baptist	Methodist	Congregationalist	Lutheran and allied	Roman Catholic	Syrian	Others	Total
Europeans	111,764	9,693	2,108	5,998	421	1,400	33,964	6	4,323	169,677
Eurasians	35,781	1,439	2,017	2,420	140	287	45,697	1	1,469	89,251
Natives	305,917	42,799	216,915	68,489	37,313	153,767	1,122,508	571,320	145,284	2,664,313
Total	453,462	53,931	221,040	76,907	37,874	155,454	1,202,169	571,327	151,076	2,923,241

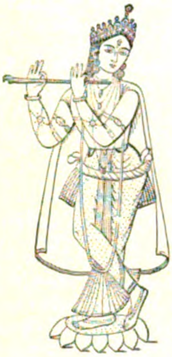
For convenience of treatment the religious development of India may be divided into the following periods: First, the Vedic era, or earliest religious beliefs of the Aryan Hindus; second, Brahmanism proper, or the faith inculcated by the priests in the religious books called Brahmanas, and in the philosophical Upanishads (q.v.); third, the period of the two great religious reforms, Buddhism and Jainism (q.v.), both of which were a reaction against decadent Brahmanism; fourth, the newer Hinduism or Brahmanic counter-reform, a wider and more catholic faith which sprang out of the schismatic reform movement; and, finally, the later Hindu sectarian outgrowths and the tendencies of the popular faiths. The *Rig-Veda* and *Atharva-Veda* represent the literature of the earliest period; the *Yajur-Veda* is nearer to the second religious phase, or the Brahmanism of the priests; the sacred books of the Buddhistic and Jainistic reformations are written respectively in Pali (q.v.) and Prakrit (q.v.); again, the great Sanskrit epic poems of the *Mahâbhârata* and the *Râmâyana* represent both the purer Brahmanic stage and the later sectarian tendencies; for the latter our chief source of information is that class of mythological works known under the name of *Purânas* (q.v.) and *Tantras* (q.v.); the material for the developments after B.C. 1500 must be gathered from various sources. With reference to the time of these eras we can only say in a general way that the Vedic period runs from a very early period down to about B.C. 1000 or a couple of centuries afterwards, and merges into the Brahmanic age, which closes perhaps about B.C. 500. The age of Buddhism was about B.C. 500 to A.D. 500, and the period of epic Hinduism, according to Hopkins, covers about the same centuries. From A.D. 500 to A.D. 1500 is the era of Brahmanic counter-reforms and of sectarianism, while since that time unifying tendencies have been more operative than ever before. It is necessary at the outset, however, to guard the reader against attempting to connect dates with the earlier of these periods. It has not been uncommon for writers on this subject to assign thousands of years before the Christian Era as the starting-points of various phases of Hindu antiquity; others, more cautious, marked the beginnings of certain divisions of Vedic works with 1200, 1000, 800, and 600 years B.C. The truth is, that since Hindu literature itself is almost without known dates, owing either to the peculiar organization of the Hindu mind, or to the convulsions of Indian history, the present condition of Sanskrit philology does not afford the scholar the requisite resources for embarking with any chance of success in such chronological speculations. The question of Hindu chronology will be more particularly considered in the article VEDA. In the meantime, the utmost stretch of assumption which in the present condition of Sanskrit philology it is permitted to make is, that the latest writings of the Vedic class are not more recent than the second century before Christ. A like uncertainty hangs over the period at which the two great epic poems of India were composed, although there is reason to surmise that the lower limits of that period did not reach beyond the beginning of the Christian Era. The Puranic period, on the other hand, scholars are generally agreed to regard as corresponding with part of our mediæval history, or roughly from A.D. 500 to 1500, although the material in these writings is often much older in its content.

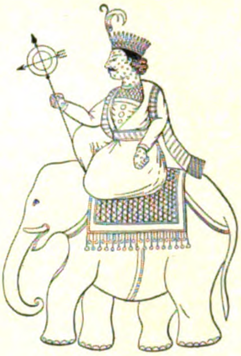
VEDIC RELIGION. If the Rig-Veda—the oldest of the Vedas, and one of the oldest literary documents in existence—coincided with the beginning of Hindu civilization, the popular creed of the Hindus, as depicted in some of its hymns, would reveal not only the original creed of this nation, but throw a strong light on the original religion of humanity itself. Unhappily, however, the imagination, indulging in such an hypothesis, would have little foundation to work on. There are, of course, numerous traces in the Rig-Veda of survivals of earlier animistic beliefs, of spiritism, fetishism, and ancestor-worship; but the Hindus, as depicted in these hymns, are far removed from the starting-point of human society; they may, in fact, fairly claim to be ranked among those already civilized communities experienced in arts, defending their homes and property in organized warfare, acquainted even with many vices which are found only in an advanced condition of artificial life. Yet in examining the ideas expressed in the greatest number of the Rig-Vedic hymns, it cannot be denied that they are neither ideas engendered by an imagination artificially influenced, nor such as have made a compromise with philosophy. The Hindu of these hymns is essentially engrossed by the might of the elements. The powers which turn his awe into pious subjection and veneration are—*Agni* (q.v.), the fire of the sun and lightning; *Indra* (q.v.), the god of the storm and the thunder; the *Maruts*, or winds (see MARUT); *Sūrya*, the sun (see SŪRYA); *Ushas*, the dawn, whose hymns are among the most beautiful (see USHAS); and various kindred manifestations of the luminous bodies, and nature in general. He invokes them, not as representatives of a superior being, before whom the human soul professes its humility, nor as superior beings themselves, which may reveal to his searching mind the mysteries of creation or eternity, but because he wants their assistance against enemies—because he wishes to obtain from them rain, food, cattle, health, and other boons. He complains to them of his troubles, and reminds them of the wonderful deeds they performed of yore, to coax them, as it were, into acquiescence and friendly help; in fact, he seeks them more for his material than for his spiritual welfare. What we should call the ethical side is less pronounced. Sin and evil, indeed, are often adverted to, and the gods are praised because they destroy sinners and evil-doers; but one would err in associating with these words our notions of sin or wrong. A sinner, in these hymns, is rather a man who does not address praises to those elementary deities, or who does not gratify them with the oblations they receive at the hands of the believer. He is the foe, the robber, the demon—in short, the borderer infesting the territory of the 'pious' man. The latter, in his turn, may injure, and kill, but, in adoring Agni, Indra, and their kin, he is satisfied that he can commit no evil act. Yet some of the hymns, especially those addressed to the supersensuous, transcendental god Varuna (q.v.), the guardian of order and right, seem to imply the strongest sense of moral obligation and of sin as we understand the word. On the whole, it may also be said that the internal condition of the Hindu community, the features of which may be gathered from the hymns, seems to bespeak union and brotherhood among its members; and the absence, in general, of hymns which appeal to the gods for the suppression of internal dissensions or public vices, bears testimony apparently to the good moral condition of the people whose wants are recorded in these songs.

It may be imagined that the worship of elementary beings like those we have mentioned was originally a simple and harmless one. It is true that the sacrifice of sheep and goats, bulls, and even horses, was known, but it was not general. By far the greatest number of the Rig-Veda hymns know of but one sort of offering made to these gods; it consists of the juice of the soma (q.v.) or moon-plant, which, pressed out and fermented, was an exhilarating and inebriating beverage, and for this reason, probably, was deemed to invigorate the gods, and to increase their beneficial potency. It was presented to them in ladles, or sprinkled on the sacred Kusa grass. Clarified butter, too, poured on the fire, is mentioned in several hymns as an oblation agreeable to the gods, and it may have belonged to the primitive stage of the Vedic worship. There were no temples of the divinities, and in early times no images. The altar, if used, was very simple. The gods easily gathered from the atmospheric region roundabout.

There is a class of hymns, however, to be found in the Rig-Veda which already depart materially from the simplicity of the conceptions we are referring to. In these the instinctive utterance of feeling makes room for the language of speculation; the allegories of poetry yield to the mysticism of the reflecting mind; and the mysteries of nature becoming more keenly felt, the circle of beings which overawe the popular mind becomes enlarged. Thus, the objects by which Indra, Agni, and the other deities are propitiated become gods themselves; soma, espe-

HINDU DEITIES


Krishna.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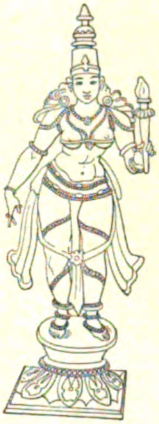
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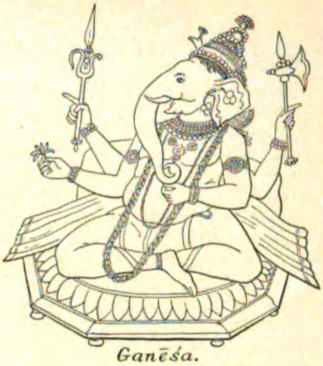
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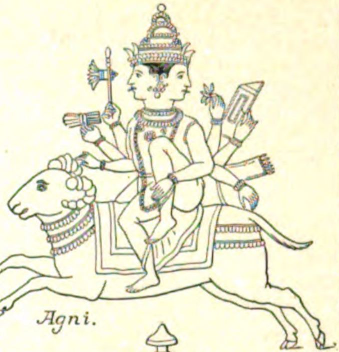
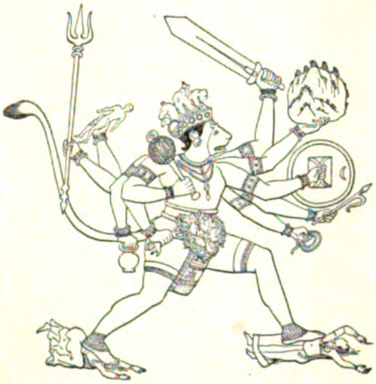
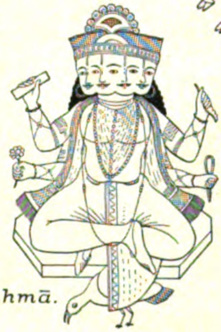
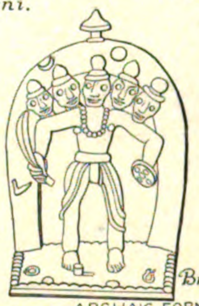
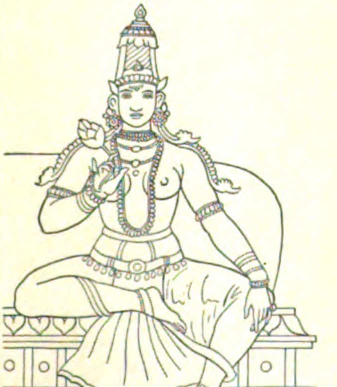
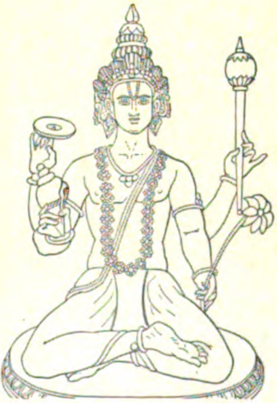

Agni.

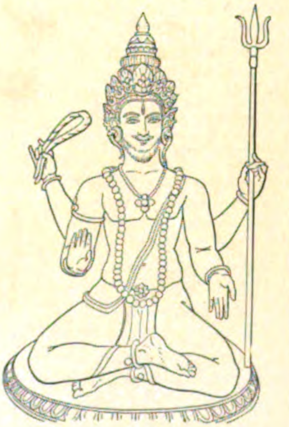

Hanumān.


Brahmā.


Brahmā.
ARCHAIC FORM


Pārvatī.


Vishnu


Śiva.

cially, the moon-plant, with its juice, is invoked as the bestower of all worldly boons. The animal sacrifice, the properties of which seem to be more mysterious than the offerings of soma, or of clarified butter—is added to the original rites. Mystical allusions and symbolic expressions begin likewise to crop out in the later portions of the Veda, revealing the fact that the Hindu mind was no longer satisfied with the adoration of the elementary or natural powers, and giving evidence that the religion was beginning to deal with the problem of the mysteries of creation. In the tenth and last book of the Rig-Veda, speculations are found with regard to the origin of the universe, the whence and the whither, the who and the what. As soon as the problem implied by hymns like these was raised in the minds of the Hindus, Hinduism must have ceased to be the worship of only elementary powers. Henceforward, therefore, we see it either struggling to reconcile the latter with the idea of one supreme being, or to emancipate the inquiry into the principle of creation from the elementary religion recorded in the oldest portion of Vedic poetry.

Brahmanism Proper. The development from the older into the newer, from the elemental and natural into the artificial, ritualistic and philosophic, or from the early Rig-Veda stage of religion into Brahmanism, may be traced through the *Yajur-Veda*, or book of knowledge of the sacrifice and the ritual. The priestly power of the Brahmans is supreme in this sacred book, and in the *Yajur-Veda* may be seen the beginnings of Brahmanism, as shown in its fuller development in the branch *Brâhmaṇas* (see Veda) and in the philosophical writings termed *Upanishad.* (See Upanishad.) In the *Brâhmanas*—a word of the neuter gender, and not to be confounded with the similar word in the masculine gender, denoting the first Hindu caste—the mystical allegories which now and then appear in what we have called the second class of Vedic hymns, are not only developed to a considerable extent, but gradually brought into a systematic form. Epithets given by the Rig-Veda poets to the elementary gods are made the bases of legends, assuming the shape of historical narratives. The simple and primitive worship mentioned in the hymns becomes highly complex and artificial. A ponderous ritual, founded on those legends, and supported by a far more advanced condition of society, is brought into a regular system, which requires a special class of priests to keep it in a proper working order. Some of the Vedic hymns seem to belong already to the beginning of this period of the Brahmana worship, for in the second book of the Rig-Veda several such priests are enumerated in reference to the adoration of Agni, the god of fire; but the full contingent of sixteen priests, such as is required for the celebration of a great sacrifice, does not make its appearance before the composition of the Brahmanas and later Vedas. Yet, however wild many of these legends are, however distant they become from the earlier veneration of the elementary powers of nature, and however much this ritual betrays the gradual development of the institution of castes—unknown to the hymns of the Rig-Veda—there are still two features in them, which mark a progress of the religious mind of ancient India. While the poets of the Rig-Veda are chiefly concerned in glorifying the visible manifestations of the elementary gods, in the Brahmanas their ethical qualities are put forward for imitation and praise. Truth and untruth, right and wrong—in the moral sense which these words imply—are not seldom emphasized in the description of the battles fought between gods and demons; and several rites themselves are described as symbolical representations of these and similar qualities of the good and evil beings, worshiped or abhorred. A second feature is the tendency, in these Brahmanas, to determine the rank of the gods, and, as a consequence, to give prominence to one special god among the rest; whereas in the old Vedic poetry, though we may discover a predilection of the poets to bestow more praise, for instance, on Indra and Agni than on other gods, yet we find no intention, on their part, to raise any of them to a supreme rank. Thus, in some Brahmanas, Indra, the god of the firmament, is endowed with the dignity of a ruler of the gods; in others, the sun receives the attributes of superiority. This is no real solution of the momentous problem hinted at in the Vedic hymns, but it is a semblance of it. There the poet asks 'whence this varied world arose'—here the priest answers that 'one god is more elevated than the rest;' and he is satisfied with regulating the detail of the soma and animal sacrifice, according to the rank which he assigns to his deities.

A real answer to this great question is attempted, however, by the theologians who explained the 'mysterious doctrine,' held in the utmost reverence by all Hindus, and laid down in the writings known under the name of *Upanishad* (q.v.). It must suffice here to state that the object of these important works is to explain, not only the process of creation, but the nature of a supreme being, and its relation to the human soul. In the Upanishads, Agni, Indra, Vayu, and the other deities of the Vedic hymns become symbols to assist the mind in its attempt to understand the true nature of the one absolute being, and the manner in which this being manifests itself in its worldly form. The human soul itself is of the same nature as this supreme or great soul; its ultimate destination is reunion with the supreme soul, and the means of attaining that end is not the performance of sacrificial rites, but the comprehension of its own self and of the great soul. The doctrine which at a later period became the foundation of the creed of the educated—the doctrine that the supreme soul, or (the neuter) Brahman, is the only reality, and that the world has a claim to be noticed only in so far as it emanated from this being, is already clearly laid down in these Upanishads, though the language in which it is expressed still adapts itself to the legendary and allegorical style which characterizes the Brahmana portion of the Vedas. The Upanishads became thus the basis of the enlightened faith of India. They are not a system of philosophy, but they contain all the germs whence the three great systems of Hindu philosophy arose; and like the latter, while revealing the struggle of the Hindu mind to comprehend the one supreme being, they advance sufficiently far to express their belief in such a being, but at the same time acknowledge the inability of the human mind to understand its essence.

From the Brahmanic religion with its theology, its sacrifice, its stifling ritual, and widespread priestcraft there was bound later to come a revolt. Premonitory symptoms of this are plainly to be seen in the Upanishads, which prepared the way for emancipation. The reform wave swept over India in the two great reactionary movements of Buddhism and Jainism. The character and extent of these reformatory movements are spoken of under special articles, and need not be discussed here. The eastern part of India was the source from which they sprang, but Jainism gradually spread westward especially, and Buddhism expanded itself over other parts of India to Ceylon and far beyond the borders of Hindustan.

HINDUISM. In spite of the reform movements, the old Brahmanism was not destined to disappear. But it was forced to undergo changes which were largely due to the influence of the protesting faiths of Buddhism and Jainism. During the very time while they were flourishing it quietly but firmly held its own, was consciously or unconsciously being remodeled and adjusted to altered conditions and environments, and was gradually but surely changing into the newer Hinduism, with all that restoration meant. It is this changing Brahmanism and earlier Hinduism in its sectarian developments that is presented to us in the great Hindu epics.

The Epic period of Hinduism is marked by a similar development of the same two creeds, the general features of which we have traced in the Vedic writings. The popular creed strives to find a centre round which to group its imaginary gods, whereas the philosophical creed finds its expression in the ground-works of the *Sānkhya*, *Nyāya*, and *Vēdānta* systems of philosophy. In the former, we find two gods in particular who are rising to the highest rank, Vishnu and Siva; for *Brahmā* (the masculine form of Brahman), though he was looked upon, now and then, as superior to both, gradually disappears, and becomes merged into the philosophical *Bráhmă* (the neuter form of the same word), which is a further evolution of the great soul of the Upanishads. In the *Rāmāyaṇa,* the superiority of Vishnu is admitted without dispute; in the great epos, the *Mahābhārata*, however, which, unlike the former epos, is the product of successive ages, there is an apparent rivalry between the claims of Vishnu and Siva to occupy the highest rank in the pantheon. It is one of the difficult problems of Sanskrit philology to unravel the chronological position of the various portions of this work, to lay bare its groundwork, and to show the gradual additions it received, which must be done before it will be possible to determine the successive formation of the legends which are the basis of classical Hindu mythology. A great deal has been done, however, and this much seems to be clear even already, that there was a predilection during this epic period for the supremacy of Vishnu, one of whose incarnations was the much-beloved Krishna (q.v.), and that the policy of incorporating rather than combating antagonistic creeds led more to a quiet admission than to a warm support of Siva's claims to the highest rank.

The philosophical creed of this period adds little to the fundamental notions contained in the Upanishads; but it frees itself from the legendary dross which still imparts to those works a deep tinge of mysticism. On the other hand, it conceives and develops the notion that the union of the individual soul with the supreme spirit may be aided by penances, such as peculiar modes of breathing, particular postures, protracted fasting, and the like; in short, by those practices which are systematized by the Yoga doctrine. The most remarkable epic work which inculcates this doctrine is the celebrated poem *Bhagavadgītā,* which has been wrongly considered by European writers as a pure Sankhya work, whereas Sankara, the great Hindu theologian who commented on it, and other native commentators after him, have proved that it is founded on the Yoga belief. The doctrine of the reunion of the individual soul with the supreme soul was necessarily founded on the assumption that the former must become free from all guilt affecting its purity before it can be remerged into the source whence it proceeded; and since one human life is apparently too short for enabling the soul to attain its accomplishment, the Hindu mind concluded that the soul, after the death of its temporary owner, had to be born again, in order to complete the work it had left undone in its previous existence, and that it must submit to the same fate until its task is fulfilled. This is the doctrine of metempsychosis, which is a logical consequence of a system which holds the human soul to be of the same nature as that of an absolute God. The beginning of this doctrine may be discovered in some of the oldest Upanishads, but its development belongs to the epic time, where it pervades the legends, and affects the social life of the nation. See METEMPSYCHOSIS.

PURANIC HINDUISM. The Puranic period, with its various cults, comprises the development of the newer Hinduism from about the sixth century of our era to the sixteenth century. The *Purāṇas* (q.v.) and the *Tantras* (q.v.) represent this phase of the religion, which succeeded epic Hinduism and supplanted Buddhism. The old Brahmanic vigor was not dead, but was ready to revive. In the eighth century Kumarila strengthened it on the ritualistic side and the great Vedantist Sankara, in the ninth century, added to its power on the philosophic side. But the Puranic period of Hinduism was a period of decline, so far as the popular creed is concerned. Its pantheon is nominally the same as that of the epic period. Brahma, Vishnu, and Siva remain still at the head of its imaginary gods; but whereas the epic time is generally characterized by a friendly harmony between the higher occupants of the divine spheres, the Puranic period shows discord and destruction of the original ideas whence the epic gods arose. Brahma withdraws, in general, from the popular adoration, and leaves Vishnu and Siva to contest in the minds of their worshipers for the highest rank. The elementary principle which originally inhered in these deities is thus completely lost sight of by the followers of the Puranas. The legends of the epic poems relating to these gods become amplified and distorted, according to the sectarian tendencies of the masses; and the divine element which still distinguishes these gods in the *Rāmāyaṇa* and *Mahābhārata* is now more and more mixed up with worldly concerns and intersected with historical events, distorted in their turn to suit individual interests. Of the ideas implied by the Vedic rites, scarcely a trace is visible in the

Purāṇas and *Tantras*, which are the text-books of this creed. In short, the unbridled imagination which pervades these works is neither pleasing from a poetical nor elevating from a philosophical point of view. Some Puranas, it is true—for instance, the *Bhāgavata*—make in some sense an exception to this aberration of original Hinduism; but they are a compromise between the popular and the Vedantic creed, which henceforward remains the creed of the educated and intelligent. They do not affect the worship of the masses as practiced by the various sects; and this worship itself, whether harmless, as with the worshipers of Vishnu, or offensive, as with the adorers of Siva and his wife Durga, is but an empty ceremonial, which, here and there, may remind one of the symbolical worship of the Vedic Hindu, but, as a whole, has no connection whatever with the Vedic Scriptures, on which it pretends to rest. It is this creed which, with further deteriorations, caused by the lapse of centuries, is still the main religion of the masses in India.

The philosophical creed of this period, and the creed which is still preserved by the educated classes, is that derived from the tenets of the Vedanta philosophy. It is based on the belief in one supreme being, which imagination and speculation endeavor to invest with all the perfections conceivable by the human mind, but the true nature of which is, nevertheless, declared to be beyond the reach of thought, and which, on this ground, is defined as not possessing any of the qualities by which the human mind is able to comprehend intellectual or material entity. See VEDANTA.

HINDU SECTS AND MODERN POPULAR FAITH. Under this designation may be comprised the sects which arose during the last period of Hinduism and the beliefs which are common to the Hindus to-day. These believers suppose that their religion is countenanced by the Vedas; but its source in reality is to be found in the *Purāṇas* and *Tantras*. They have in common a general sort of recognition of the Hindu trinity or triad—Brahma the creator, Vishnu the preserver, and Siva the destroyer—but in practice they are either Vishnuites or Sivites; for Brahma is little more than an abstraction, and plays a very subordinate part to-day contrasted with his rivals. Sivaism may loosely be said to be more popular in the northeast and south of India; Vishnuism rather in the northwest, but also in the south. The wives or female energies of these two gods also receive adoration. (See VAISHNAVAS; SAIVAS; SAKTAS.) Common to them all are certain acts of worship; the offering of votive gifts, adoration in the temples, and the performance of special ceremonies, such as the fulfillment of vows by going on religious pilgrimages for the purpose of acquiring merit. The caste system also has a strongly religious bearing, although it tends to break down through association with Occidentals. (See CASTE.) Beside the great sects there are likewise some of limited extent and total insignificance, such as the worshipers of Agni, the god of fire; of Surya, the sun god; of Ganeśa, the god of wisdom and remover of obstacles. Some of these latter sects were looked upon as partly unorthodox, partly heterodox, as early as the ninth and fourteenth centuries of our era. Regarding the sect of the Sikhs, which arose in the fifteenth century, reference may be made to the special article on that topic. Reform movements in India have been familiar since the early days of Buddhism and Jainism, down through Sikhism to the modern times. In the nineteenth century a special religious agitation was set on foot by Rammohun Roy (1774-1833) (q.v.), which resulted in the establishment of the Brahmo-Somaj (q.v.), a sort of national church of the Hindus. The movement has extended widely throughout India, and, like the Arya-Somaj, it is eclectic in its tendencies, seeking to combine the teachings of the Veda with the tenets of the Bible and the sacred books of other faiths. There are also in India some 17,000 believers in the Jewish religion, and allusion has been made above to the presence of some 90,000 Parsis, who made their home in India more than a thousand years ago. These topics are treated under separate headings, and need only be referred to here.

CHRISTIANITY IN INDIA. With reference to the spread of Christianity in Hindustan, as mentioned above, it may be stated that India was one of the earliest fields of Christian missions. Tradition assigns it as the scene of the Apostle Thomas's labors and martyrdom. Whether this was the case or not, we find a Syrian church planted in Malabar in Southern India, which undoubtedly had a very early origin. The Jesuit missionaries, from the middle of the sixteenth century onward, had a large success in India. (See FRANCIS XAVIER.) The earliest Protestant missionaries in India came from Holland and Denmark. With the latter mission the eminent Schwartz was connected. England's first missionary effort was made by the Society for the Propagation of the Gospel, and the Christian Knowledge Society, which commenced in the beginning of the eighteenth century, by aiding the Danish mission already established in Southern India. Subsequently, the East India Company adopted the policy of excluding missionaries altogether from their territories; but since the beginning of the last century, when these restrictions were withdrawn, great activity has been manifested, in which all denominations are represented. In the proclamation to the princes, chiefs, and people of India, read in the principal cities, on November 1, 1858, it was declared "that none shall be in any wise favored, none molested or disquieted, by reason of their religious faith and observances, but that all shall alike enjoy the equal and impartial protection of the law." The fullest toleration in matters of faith is the rule throughout British India. Fanaticism only, as when it sought to enforce the burning of widows or suttee (q.v.), or to offer human beings in sacrifice, is curbed by the ruling power. There is no exclusively endowed State Church, but the Government continues to pay the State grants made to Hindu temples and to Mohammedan mosques. Clergymen of the Church of England, the Church of Scotland, and the Roman Catholic Church, are retained on the Government establishment as civil or military chaplains. There are Church of England bishops at Calcutta, Madras, and Bombay. The number of Christians in India in 1901 was given in the census as 2,923,241, of whom the majority (1,202,169) were Roman Catholics. The members of the Church of England numbered 453,462, and the Syrian and kindred sects 722,403. The rest belonged to Protestant denominations.

For a study of the entire religious development of the Hindus, consult Hopkins, *Religions of India* (Boston, 1895); Barth, *Religions of India* (3d ed., London, 1890); Monier-Williams, *Hinduism*, in the series of *Non-Christian Religious Systems* (London, 1900); Hardy, *Indische Religionsgeschichte* (Leipzig, 1898); Wilkins, *Modern Hinduism* (2d ed., London, 1887).

Archæological Remains. The antiquities and the archæological remains in India are largely of an architectural character. (See Indian Art.) From the prehistoric age there are no monuments surviving beyond possibly some cairns and cromlechs; and the same is true of the Vedic period of Aryan India, because the structures were mostly of wood or of destructible material. Indian archæology begins practically with the age of Buddhism and Jainism. Connected with these faiths there are characteristic shrines, temples, and monuments in various parts of India, dating from B.C. 250 onward. Most famous from the standpoint of archæological research is the great cave at Karli, and also the caves at Ajanṭa, Ellora, and Lena, constructed with their assembly halls or churches (*chaityas*) and their monastic cells (*vihāras*). Of like interest are the huge mounds or tumuli (*stūpas, tōpes*), like that at Sanchi, near Bhilsa, erected to contain in a shrine (*dāgoba*) some relic of Buddha. The rails about these structures are well known because of their artistic value and because of the light they throw on scenes connected with Buddhist life. (See Gautama Buddha; Jataka.) Of particular antiquarian interest, likewise, are the various columns or shafts (*stambhas, lāts*), set up in various parts of India by King Aśoka (q.v.). The inscriptions on these, like his rock-cut edicts, are of special importance. Under a slightly different category, but of similar antiquarian interest, are the famous Gandhara sculptures, representing incidents in Buddha's life. The influence of Græco-Bactrian art is plainly evident in these. Of a much later date, but quite Hindu in character, are the cave temples of Elephanta (q.v.), near Bombay, with their sculptured figures of Brahma, Vishnu, and especially Siva. These may not, however, antedate the ninth century of our era. The remaining groups of antiquarian remains, chiefly architectural, are grouped under the head of Dravidian architecture, the Bengali and Chālukyan style of temple structure, and the artistic building of the era of Mohammedan rule. For details regarding these consult Fergusson, *History of Indian and Eastern Architecture* (London, 1876), and Le Bon, *Les monuments de l'Inde* (Paris, 1893). In 1897 arrangements were made in connection with the International Congress of Orientalists to establish an Association for Archæological Research and Exploration in India, and special archæological work under the supervision of the French Government has since been carried on in Cambodia, besides the researches conducted by various scholars individually in India itself.

Language. With its hundreds of millions of inhabitants, there is as great a diversity of languages in India as there is variety in the peoples themselves. By far the larger majority, over 210,000,000, speak languages or dialects belonging to the Indo-Germanic group of tongues, and related, though perhaps not by direct descent, to the ancient Vedic dialect. This Indo-Aryan division is therefore first in importance, and three periods or stages may be recognized in its historical development. The earliest of these is sometimes called the Old Indic speech, and includes the Vedic dialect, Pali, in the broad sense now given to this term, and the literary or classic Sanskrit. The second period embraces the Middle Indian Prakrits. (See Prākrit.) The third, termed New Indian, includes the modern Indian vernaculars, which are in the main descended from popular Prakrit dialects, and are spoken largely in the north, east, and central provinces of India. Under this designation are comprised Punjabi, Kaśmiri, and Sindhi, the speech of over 20,000,000 people, on the north and west; next, the Hindi, spoken by 80,000,000, and called Urdu or Hindustani when admixed with Persian and Arabic; again Gujarati and Marathi, the chief languages of the Bombay Presidency, and claiming nearly 30,000,000 speakers; furthermore, Bengali, the vernacular of more than 40,000,000 individuals in the east, together with Uriya and Behari, likewise in Eastern India; also Nepali, the language of Nepal, and Assami, still farther to the east. Separate articles regarding the characteristics of these various Indo-Aryan vernaculars will be found under the individual names. Among the non-Aryan languages the most important family is the Dravidian (q.v.), the tongue of some 50,000,000 people, inhabiting the peninsular portion of India. The Kolarian or Munda branch numbers about 3,000,000 speakers, while the Tibeto-Burman family has more than twice as many. The Khasi group (Assam) and the Mon-Annam and Shan families aggregate together over half a million speakers. In addition to this the division of Iranian languages (q.v.) is represented on the borders of Afghanistan and Baluchistan, and in the speech of the Gypsies; the linguistic statistics of India include, moreover, the languages, like English, German, French, etc., which are used by Europeans resident in India, and similarly such other languages as may be used by various Asiatics living at the time in Hindustan. (See Indian Peoples.) In addition to the bibliographical references given under the various separate articles, consult: Cust, *Modern Languages of the East Indies* (London, 1878); Constable, *Hand-Atlas of India* (Westminster, 1893); Beames, *Comparative Grammar of the Modern Aryan Languages of India* (London, 1872-79); Hoernle, *Comparative Grammar of the Gaudian Languages* (London, 1880); Baines, "The Language Census of India," in the *Transactions of the Ninth International Congress of Orientalists* (London, 1893); Grierson, *Linguistic Survey of India* (London, 1898).

HISTORY.

The early history of India is wrapped in legend. Only by references in native or in foreign writings and by inscriptions can the story of the ancient period be reconstructed. The Indian mind is essentially an unhistoric one. We have, indeed, many sovereigns mentioned, and even whole dynasties given in the *Purāṇas* (q.v.), in the epics, and in other Sanskrit writings; but of history, in the real sense of the word, there is practically none. The accounts which are given are so interwoven with myth and fancy that they have almost no value to the historian. From other sources, however, much of India's past may be outlined. Indian history falls roughly into three periods: The Hindu period (c.2000 B.C. to 1001 A.D.), the Mohammedan period (A.D. 1001-1757), and the period of the establishment of European dominion (1757—).

HINDU PERIOD. The Aryans (q.v.) entered the Punjab perhaps as early as B.C. 2000. They came from the Iranian country, apparently by two routes, through the mountain passes in Southern Afghanistan and by way of Chitral, and gradually forcing their way east and south, expelled or subdued the aborigines, such as the Dravidians, and occupied the entire territory north of the Vindhya Mountains. There are but few historic allusions in the earliest part of this period, although the Rig-Veda (q.v.) mentions a battle of ten kings against Sudas, King of the Tritsu clan, evidently a tribal war, and contains a number of references to Aryan victories over the aboriginal tribes. The epics of the *Mahābhārata* and the *Rāmāyaṇa* contain legends of wars which must have been of much importance. The former epic narrates almost as its main theme the strife between the Kurus and Panchalas, both on the Upper Ganges, while the latter tells of the war waged by the Kosalas of Oudh against the demoniac armies of Lankia, supposed to be Ceylon. By the close of the period described in the former epic there were ten great Hindu kingdoms: Magadha (South Behar), Anga (West Bengal), Vanga (East Bengal), Kalinga (Orissa), Avanti (Malwa), Saurashtra (Gujarat), and the kingdoms of the Andhras (Deccan), the Cholas (Coromandel), the Cheras (Malabar), and the Pandyas (extreme south). Of these Magadha became the chief before the dawn of authentic history in India. The earliest historic Indian date thus far known is B.C. 557, the reputed birth-year of Buddha. Bimbsara (q.v.) of the Saisunagar dynasty began to rule soon after this (died 485 B.C.), and this line reigned until the early part of the fourth century. In B.C. 315 during the reign of the Maurya king Chandragupta, called by the Greeks Sandracottus (q.v.), who brought all Northern India under the sway of Magadha, India for the first time in the historic period came into relations with the Occident. The invasion of Alexander the Great was to be the forerunner of a long series of inroads, which were to end two thousand years later in the final surrender of India to the West. The stay of Alexander in India was short, but Sandracottus entered into an alliance with the Greek ruler of Persia and Bactria, Seleucus Nicator, whose daughter he married, and to whose ambassador, Megasthenes (q.v.), we are indebted for our earliest non-Indian information on Hindustan. The great Sandracottus was succeeded by his son Bindusara in B.C. 291, and his grandson, Aśoka, whose reign lasted approximately from B.C. 259 to 222, is famous as the royal promulgator of Buddhism. A series of weak kings followed, and the foreign influence on India steadily gained strength. A half-century after Aśoka's time the Græco-Bactrian dynasty extended its power over the Upper Ganges and the Punjab, only to be driven out by the Indo-Scythians about B.C. 100. The greatest monarch of this line was Kanishka, a Kushana king, who founded the Saka (or Salivahana) era (q.v.) in A.D. 78. The northwestern (Kabul) Indo-Scythian princes gave way in the second century A.D. to the western (Gujarat) Kshatrapas, who in turn were overthrown by the Guptas toward the end of the third century. The name of Chandragupta I. (about 319) is one of the most important in this dynasty. He made his house supreme over practically all Northern India, and his son, Samudragupta, was equally powerful. The power of the Guptas was finally broken in the early part of the sixth century, having previously been weakened by invasions of the Huns. During the Gupta period the Hindus flourished in arts and in religion, and the so-called Renaissance of Sanskrit literature came in the reign of Vikramaditya (about 455-480). It was about this time that Buddhism attained its acme in India. To this fact we are indebted for some of our best information regarding the condition of the land. Chinese travelers, notably Fa-Hien (400), Hiouen-Thsang (643), and I-Tsing (671), came to India seeking for a knowledge of Buddha's teachings in their purity, and the records which they left form the only non-Indian information on Hindustan which we possess from the time of the Greeks until the coming of the Arabs. In the first half of the sixth century Harshavardhana, who was the hero of the one historical romance in Sanskrit, extended his sway over all Northern India, even conquering Nepal. From this time the Hindu power began gradually to decline. Of the succeeding dynasties the most important were the Chalukja and Chola, but the day of native monarchy over India was past. Petty kings came and went, warred with each other, and by their lack of harmony helped to prepare the way for the second great epoch of India, the Mohammedan period. The subject of early Hindu eras and dates is very involved, and only the chief epochs can be given here. Hindu chronology begins with the Kaliyuga (q.v.), B.C. 3102; Chandragupta established the Maurya dynasty B.C. 315; Aśoka was crowned B.C. 259; the Samvat (q.v.) era (attributed wrongly to Vikramaditya, who lived much later) begins B.C. 57. This is the chief era of India. The Saka (q.v.) or Salvahana era begins A.D. 78; the Gupta or Vallabhi era A.D. 319; the Harshavardhana era A.D. 606; the modern Burmese era, A.D. 639. According to a new theory of Bhandarkar (not yet accepted by scholars generally), the Saka and following dates have to be increased by 200.

MOHAMMEDAN PERIOD (1001-1757). *House of Ghazni* (1001-1186).—The Sultan Mahmud of Ghazni, founder of the House of the Ghaznivides (q.v.), was the first conqueror who permanently established the Mohammedan power in India, and the Hindu princes fell one by one before a succession of Mohammedan dynasties. The House of Ghazni succumbed to the *House of Ghor*, which was supplanted by the *Slave Kings of Delhi* (1206-88). One of these sovereigns, Altamsh, who ascended the throne in 1211, added the greater part of Hindustan proper to his dominions. He died in 1236. *The Khilji Dynasty* (1290-1320).—Under Ala ud-Din (1295-1316), of the House of Khilji, the Afghan power in India reached its highest point. He crushed the Hindus in Gujarat, defeated the Moguls in several battles on their invading the Punjab, and, most important of all, invaded the Deccan. Like so many Oriental conquests, however, his success was but temporary. *House of Tughlak* (1320-1414).—Ala ud-Din's descendants having been slain, Tughlak, Governor of the Punjab, seized the throne in 1320. The Tughlak dynasty was short-lived; and in 1398, during the reign of the last of the Tughlak kings, the Tatar Timur, or Tamerlane, sacked Delhi, and proclaimed himself Emperor of India. Two short-lived and unimportant dynasties followed the Tughlaks, the *House of Sayyid* (1414-50), and the *House of Lodi* (1450-1526). To the kings of this dynasty succeeded the *Great Moguls of the House of Timur* (1526-1707). Baber (q.v.), a descendant of Timur, who had for twenty-two years been sovereign of Kabul, invaded India for the fifth time toward the end of the year 1525, and after defeating Sultan Ibrahim Ludi on the plain of Panipat, April, 1526, he entered Delhi in triumph, and established himself as Emperor of the Mohammedan dominions in India. He died in 1530, and was succeeded by his son, Humayun. Akbar (q.v.), son of Humayun, one of the greatest of Mohammedan monarchs, became Emperor in 1556, and reigned for nearly fifty years. His son, Jehangir, ascended the throne in 1605, and his grandson, Shah Jehan (q.v.), at the beginning of 1628. Shah Jehan is celebrated as the builder of the Taj Mahal at Agra (q.v), one of the most splendid monuments of Oriental architecture. In 1658 Shah Jehan was imprisoned by his son, the famous Aurungzebe (q.v.), who usurped the Imperial power. This remarkable man raised the Mogul Empire to the highest pitch of greatness and splendor. The death of Aurungzebe took place in 1707, and the decay of the Empire, which had begun a few years before, proceeded rapidly. In 1739 the Persian Nadir Shah invaded India, sacked Delhi, and carried away the famous peacock throne, as well as a vast amount of treasure. Viceroys of the Great Mogul formed their provinces into independent States; while Hindu and Mohammedan adventurers carved out kingdoms with the sword. Of these the most important were the nizams of the Deccan, the rajahs of Mysore, the peshwas of the Mahrattas, and the Rajput and Sikh princes. The Mahrattas reached the height of their power about the middle of the eighteenth century, but in 1761 they sustained a crushing defeat at the hands of the Afghan ruler, Ahmed Shah (q.v.), in the battle of Panipat. The dismemberment of the Mogul Empire opened a wide field for admission and enterprise to the nations of Europe. The Venetians, the Genoese, the Portuguese (the first to reach India by way of the Cape of Good Hope in 1498), and the Dutch had by turns traded with India; and in 1602 the English appeared on the scene. See East India Company.

In 1653 Madras was erected into a presidency, and in 1668 the island of Bombay, which was the dowry of Charles II.'s Queen, the Infanta Catharine of Portugal, was transferred by the Crown to the East India Company. The year 1686 witnessed the foundation of Calcutta. The French East India Company was chartered in 1664. See Gama (Vasco da), Albuquerque, Goa, Pondicherry, Chandernagar.

British Rule (1757—). Great jealousy existed between the English and the French. The war for ascendency began in 1745, and did not end until the Peace of Aix-la-Chapelle in 1748. (See Dupleix.) The struggle in the Carnatic continued with ardor under the pretext of supporting the claims of rival native princes to sovereignty. Clive (q.v.), one of the most famous persons in Anglo-Indian history, turned the contest in favor of the English. His memorable defense of Arcot in 1751 broke the spell of French invincibility. Five years afterwards, however, Siraj-ud-Daula, Nawab or Governor of Bengal, attacked and captured Calcutta. The English prisoners, 146 in number, were confined in the small military prison known as the Black Hole, and only 23 survived till morning. Clive quickly took command of an expedition fitted out at Madras, recovered Calcutta (1757), and, assisted by Admiral Watson, prosecuted the war vigorously, till, after a hollow peace and a renewal of hostilities, he thoroughly defeated Siraj-ud-Daula in the battle of Plassy, June 23, 1757. This victory gave the English the provinces of Bengal and Behar, and from this year is dated by the English themselves the foundation of their Empire in India. From Mír Jafar, whom the East India Company appointed to succeed the defeated Nawab, they exacted vast sums of money. The government of an empire by a commercial corporation was a strange political experiment. Naturally the members had no thought of administering affairs for the benefit of their subjects, or even of far-reaching improvements in their own interest, but were guided throughout by the narrowest and most sordid selfishness. After the victory of the English at Baxar in 1764, over the united forces of Shuja-ud-Daula, Nawab of Oudh, and the Mogul Emperor (Shah Alam), the latter asked protection of the English. He confirmed the Company in its possessions and granted it the collectorate (*dīwāni*) of Bengal, Behar, and Orissa, on condition of receiving the sum of £300,000 as tribute to himself from Bengal, and £600,000 as an annual allowance to his Nawab. These enormous grants were soon cut down by Clive, and were eventually repudiated by the Company, which also failed to fulfill other engagements which it had entered into with Shah Alam. On the other hand, the cost to the Company of maintaining its authority and standing army prevented it from undertaking public works and from developing the resources of the country. Clive purged the Indian Government of oppression, extortion, and corruption; from the work he did during his last visit (1765-67) began a purer administration of the British Empire in the East. The Regulating Act, passed in 1773, substituted a new council of four at Calcutta in place of the far larger council which had hitherto managed affairs for the Company. The new body was to assist and check the Governor-General, instituted in the same year. It was also given a limited control of the actions of the Madras and Bombay presidencies, and was thus made the political head of the British possessions. To Warren Hastings (q.v.), the first Governor-General (1774-85), the new council was exceedingly hostile. Hastings, on his part, used unscrupulous means of replenishing the Company's exchequer, but by his talent and energy he averted dangers which threatened the British supremacy in India. The powerful Mussulman sovereigns, Hyder (Haidar) Ali, ruler of Mysore, and the Nizam of the Deccan, assisted by French officers, combined with the Mahrattas against the English. Sir Eyre Coote broke up the confederacy, and defeated Hyder Ali in 1781. Next year the Supreme Court of Justice, which had always harassed the Governor-General, was deprived of its independent powers, and the policy of Hastings was successful, both in the council and in the field. In 1784 Pitt instituted the Board of Control under a Cabinet Minister. By this act the English Government began to deprive the Company of its monopoly of political power in India. Lord Cornwallis (q.v.), who succeeded Hastings in 1786, was both Governor-General and commander-in-chief. To check the corruption of the English revenue officials, he made the *zemindars* (native collectors of revenue) proprietors of their districts on condition of paying a fixed annual sum to the Company. He also improved the judicial administration by forbidding a revenue official to act as a judge. These were his chief reforms. With the Nizam, the Mahrattas, and the Rajah of Coorg as allies, Cornwallis in 1790 made war on Tippu, Sultan of Mysore, who had invaded Travancore, then under British protection. Terms were dictated to Tippu at his capital, Seringapatam, and he was compelled to cede half of his domains to the Company. Cornwallis was succeeded by Sir John Shore (1793-98), whose rule was in no respect memorable. Shore was followed by the Marquis of Wellesley (1798-1805). The British Empire in the East, like that of Napoleon I. in Europe, could be maintained only by constant fighting. Tippu broke his faith by intriguing against the English, both with the French and with native princes. His bad faith cost him his crown and life; in May, 1799, Seringapatam was stormed and Tippu killed. The Hindu dynasty displaced by Hyder Ali was restored, and the administration was carried on successfully for the young Rajah by Sir Arthur Wellesley, afterwards Duke of Wellington. In the famous battle of Assaye in 1803, he defeated the Mahrattas under Sindhia, and the victories of Lord Lake in Northern India extended considerably the dominions of the Company. As Lord Wellesley's policy was too aggressive to suit the views of the East India Company, he was superseded by Lord Cornwallis, who returned to India only to die. Lord Minto, who governed from 1807 to 1813, organized the districts conquered by Wellesley. This administration was peaceful—a reaction of the profit-seeking Company against the ambitious policy of Minto's predecessor.

The Marquis of Hastings (1813-23) conquered the Gurkhas of Nepal, forced the Mahratta ruler of Indore to cede a great part of his territories, crushed the robber gangs called Pindaris, and made the British power supreme in India. The next administrations were those of Earl Amherst (1823-28) and Lord William Bentinck (1828-35). The first was signalized by the first Burmese War, the second by the suppression of suttee and the thugs. It was Bentinck, in fact, who introduced the idea of governing India for the good of the governed. The Earl of Auckland (1836-42) followed Bentinck. He is known chiefly by his unjustifiable and disastrous attempt to make British influence paramount in Afghanistan (q.v.). An unexpected insurrection in Kabul compelled the retreat of the British army, which was overwhelmed in the Kurd-Kabul Pass (1842). Auckland was succeeded by the Earl of Ellenborough (1842-44). The 'army of retribution' proceeded to Kabul soon after Lord Ellenborough took the reins of government. Kabul was sacked and several public buildings razed to the ground, after which the country was evacuated and Dost Mohammed allowed to reoccupy his throne. The conquest of Sindh by Charles Napier, followed by its annexation, also belongs to this administration. Lord Ellenborough having been recalled by the East India directors, from alarm at his martial tendencies, Sir Henry Hardinge (1844-48) was sent to take his place. The attention of the new Governor-General, however, was soon diverted from works of peace to battle with the bravest people of India. Ever since the death of Runjit Singh, the ally of the English in 1839, the Punjab had been in a state of disorganization. The Sikhs, uneasy at the conquests made by the British in Sindh and Gwalior, resolved to invade British territory. The first Sikh war (1845-46) commenced on the part of the Punjab by the passage of the Sutlej, and was followed by the bloody battles of Mudki, Firozshah, Aliwal, and Sobraon, in which, after hard fighting, the Sikhs were defeated with great slaughter. The result of the war was that a British Resident and British troops were stationed at Lahore, although the boy prince, Dhulip Singh, was acknowledged as Maharajah under a protectorate. The Cis-Sutlej States, the Jalandhar Doab, and the region between the Ravi and the Sutlej were annexed.

The administration of the Marquis of Dalhousie (1848-56), who succeeded Hardinge, is memorable for the commencement of superb public works, the introduction of cheap uniform postage, railways, telegraphs, improvements in government, and social progress generally; a second Sikh war, ending in the victory of Gujarat, February 21, 1849; a second Burmese war, finished in 1852; and the annexation of four kingdoms—the Punjab, Pegu, Nagpur, and Oudh, besides lesser territories, such as Satara. The organization of the Punjab into a model province, soon to become notable for prosperity as well as for its faithfulness to England, was a splendid achievement, of which Dalhousie had reason to be proud. When Lord Canning (1856-62) assumed office, everything promised peace and prosperity. With the early days of 1857, however, came the first mutterings of the storm that was to sweep over a large portion of British India. At the commencement of the year cakes of flour were circulated mysteriously through the region of the Upper Ganges; by this means the natives were concerting rebellion. Treasonable placards appeared at Delhi, and other suspicious occurrences gave warning of native disaffection or conspiracy. The chief causes of discontent seem to have been the annexation policy and the rapid introduction of modern European improvements, which, by threatening to destroy the whole native civilization of India, roused the fears and superstitions of Hindus and Mohammedans alike. At the same time the English civil and military officials failed to respect the religious feelings of their subjects. For instance, the Enfield rifle with its cartridge, greased with tallow and lard, was at this time put into the hands of the Sepoys without explanation or precaution; and General Anson, the commander-in-chief, snubbed caste, and was against all concession to the 'beastly prejudices' of the natives. It must be remembered that the Hindu considered the cow sacred, and he would lose caste by tasting anything prepared from its meat, while the Mohammedan was not permitted by his religion to eat pork. Suddenly the disaffection broke out into open revolt before the English were aware of the impending danger. On May 10, 1857, the Sepoy Mutiny began at Meerut, a town in the neighborhood of Delhi, with a frenzied uprising of the native troops, who had been exasperated by the imprisonment of a number of their men who had refused to handle English cartridges. The mutineers liberated their comrades and proceeded to massacre the Europeans. The British troops failed to act promptly, and the Meerut Sepoys rushed to Delhi to raise the standard of the fallen Mogul. His person, invested with the traditions of native sovereignty, naturally became the centre of rebellion. Delhi at once fell into the hands of the mutineers. Nana Sahib of Bithur, whose claims as the adopted son of the Peshwa of the Mahrattas had not been recognized by the British Government, fanned the insurrection. At the end of June General Wheeler was forced to surrender to him at Cawnpore; and, in spite of the promise of safe conduct to Allahabad, all the men were immediately massacred. The women and children were butchered on July 15th, by order of Nana Sahib, when he heard of Havelock's march from Allahabad. Nana Sahib was unable to withstand Havelock, who entered Cawnpore. The Europeans in the residency at Lucknow were besieged on June 30th. Four days afterwards, the commandant, Sir Henry Lawrence, died of his wounds, and his place was taken by Inglis, who bravely held out till he was relieved, on September 25th, by the heroic Havelock. The final relief was achieved by Sir Colin Campbell, and on November 17th the city was again in complete possession of the British. In the meanwhile, in September, Delhi was retaken by General Archdale Wilson. By June, 1858, no city or fortress of any importance remained in the hands of the mutineers. Oudh was entirely reduced by the beginning of the year 1859. The able rebel leader, Tantia Topi, a Mahratta Brahman, was taken, tried by court-martial, and hanged. During the mutiny valuable assistance and protection were received from many native chiefs. On the other hand, it was the fate of the last representative of the East India Company to sentence the last Great Mogul and heir of the House of Timur 'to be transported across the seas as a felon.' He died in Pegu in 1862. The transfer of the Government of India to the British Crown (1858) was the immediate consequence of the mutiny. Under the system then inaugurated, the Government of India is vested in a Principal Secretary of State, responsible to the Crown, and assisted by a council sitting in London. Subject to this authority is the Governor-General, henceforth termed the Viceroy, aided by an Executive Council, corresponding to the old Council of Calcutta, and by a new Legislative Council, composed in part of non-official members, native as well as European. The first Viceroy was Lord Canning. The two following Viceroys were the Earl of Elgin (1862-63) and Sir John Lawrence (1863-69). Toward the close of Lord Elgin's administration, a Mohammedan rising in Northwest India was apprehended, and it was considered most desirable that the new Viceroy should have practical experience of Indian affairs. Sir John, afterwards Lord Lawrence, was accordingly appointed Viceroy. He conducted the Government with prudence and zeal; but unfortunate events occurred during his term of office. A war in Bhutan terminated unsatisfactorily for England in 1865; and a dreadful famine in Orissa, resulting from a drought, caused the death of 1,500,000 people. He was succeeded by the Earl of Mayo (1869-72). This administration was inaugurated by a great demonstration at Ambala, March 27, 1869, when the Ameer of Afghanistan was received in state and given a supply of arms, and the first installment of a money subsidy of £120,000 a year. In returning from Rangoon to Calcutta, the Earl of Mayo was assassinated by a convict, February, 1872. Lord Northbrook (1872-76) was the next Viceroy. The chief events of his administration were 'the Bengal famine,' which, however, was foreseen and provided for, and the visit of the Prince of Wales to India (1875). Northbrook was followed by Lord Lytton (1876-80). The most important events in the tenure of office of Lord Lytton were the proclamation of the Queen as Empress of India (1877), another famine, and the Afghan War (1878-80). The Marquis of Ripon (1880-84), the Earl of Dufferin (1884-88), and Lord Lansdowne (1888-93) were the next three Viceroys, under whose administrations much was done for the improvement of the natives. In 1885 King Thebau of Burma was dethroned, and on January 1, 1886, the country was formally annexed by the English. The Earl of Elgin became Viceroy in 1893. During his term of office the demarcation of the boundary between Afghanistan and India, as determined by the Durand Treaty of 1893, was practically completed. In 1895 the region called Bashgal, in the basin of the Chitral River, was taken from the British sphere of influence, and annexed to Afghanistan. In 1895-96 the Government was called upon to deal with a mutiny of the fanatical Moplahs in Southwest India. They held out stubbornly, but were at last put down. In 1897 there was a far more serious outbreak of the Afridis on the Afghan frontier, and several sharp engagements between them and the British occurred during the summer. In addition to these difficulties, the administration had to contend with famine and plague. Notwithstanding all discouragements, however, Elgin made substantial progress in internal improvements. In 1899 Lord Curzon of Kedleston became Viceroy. In that year the gold standard was established. The famine, continuing through the year, affected 30,000,000 people. Some disaffection appeared among the Mahrattas, and at Poona violent demonstrations were made against the Government. But the country, as a whole, was loyal; and on the outbreak of the South African War, several native chiefs offered their services to the British Government.

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INDIA, FRENCH. Possessions of France in India, comprising the five towns of Pondicherry, Chandernagar, Karikal, Mahé, and Yanaon (see these respective titles), with a total area of about 196 square miles. Population, in 1901, 275,094. For history, see under EAST INDIA COMPANY, section *French East India Company;* CLIVE; DUPLEIX; and LA BOURDONNAIS.

INDIA, FURTHER, or FARTHER. See INDO-CHINA.

INDIA, NATIVE STATES OF. The native States of India consist of over 600 States, which do not come under the administrative system of British India, but have varying degrees of independence, and are mostly governed by native princes. Many of the States are quite small, but some are very large. The total area is 679,393 square miles, with a population of 62,461,549. It is noteworthy that, excepting Travancore, these States are located in the interior of the country. The population is very heterogeneous. In many of the States the ruler belongs to a minority or alien race and religion.

The early policy of the East India Company was to make alliances with the different States, recognizing the native princes as its equals. The plan did not prove satisfactory, as it was impossible to preserve harmony while the native princes were not subject to more positive restraint. The policy was then introduced of recognizing them as subordinates, and limiting their military forces, the British themselves guaranteeing protection, and taking charge of the external relations of these States. In the middle of the nineteenth century the policy of annexation was followed for a short time—Oudh, for example, being annexed in 1856. But since the Sepoy Mutiny (1857) the policy has been to allow the States to enjoy a share of independence under native rulers. The extent to which the British authority is exercised over the native States varies greatly between different States and at different times in the same State. They are not permitted to make wars or to receive foreign consuls. The commercial treaties made by the British embrace also the native States, their interests being recognized as identical with those of the provinces. The guaranty of protection implies the right to establish such military forces within the native territories as the purposes of defense demand, and to have control of railroads and telegraph lines which are not 'local,' i.e. do not begin and end within the States. Each State is thus protected from external attack and internal revolt, and a large local army is not necessary.

Since the peace of the Empire is in danger of being broken by disputes over the succession to the rulership in any State, or the rule of certain candidates may be deemed prejudicial to the Imperial welfare, the British may intercede to determine who the successor shall be, and no one to whom they object can be advanced to the chieftaincy. If flagrant and intolerable instances of misrule arise, the right of interference is presumed to follow as a further consequence from the rôle the Imperial Government plays as guarantor of the protection of the States' general welfare. Under special circumstances, as, for instance, the murder of a British commissioner, the British have resorted to some extraordinary methods of interference. But ordinarily in the important States the rulers are given a free hand in determining the State policy and executing it. In the numerous small States the Imperial jurisdiction is usually much more extensive, and many of them are administered by a British officer in the name of the chieftain. The British at times have exercised absolute rule even in some of the larger States. Their rule in Mysore had extended over half a century when (1881) it was restored to native rule. Some of the States pay a tribute to the British, but it is always small, and usually by way of compensation for special services. The policy of allowing native States to exist alongside of British provinces has its advantages and disadvantages. Eminent Indian officials hold that as far as British interests are concerned it would be better to annex a number of the leading States. The fact that this is not done is assumed to be an evidence of the unselfish motives of the Imperial policy. The proximity of the native States causes such inconveniences as rise out of the different prevailing systems of currency, limitations in the development of the Imperial irrigation system, and violations of the regulations concerning the growing of the poppy. It also tends to render certain laws inoperative—as, for instance, those against infanticide.

In order to facilitate the relations with the native States, to watch over the course of affairs within their territories, and be in a position to exert a needful influence, the British appoint political agents to the various States. With rare exceptions, the agent resides within the territory to which he is accredited. The agents to the principal States are under the immediate jurisdiction of the Imperial Government. The general condition of affairs in the native States compares unfavorably with that prevailing in regions under British administration. The British claim that the burden of taxation upon the masses falls heavier in the States than in the provinces. At the same time the public is benefited much less, for the expenditure is largely for the unnecessary wants of the ruler and his coterie of adherents, while roads, irrigation, schools, and other public needs are sadly neglected. Freedom of the press is not tolerated. It is claimed that communities which have been transferred from native to provincial administration have invariably protested against being transferred back under a native administration. Laws are made or revoked as it suits the whim of the ruler. Mysore, the most progressive of the States, has a so-called 'representative assembly,' but its members have no vote in making the laws or appropriations. Rural boards have also been established in this State, but they have no money at their disposal. Consult the authorities referred to under INDIA, paragraphs *History* and *Government;* and for a more detailed statement concerning the different States, see the articles under their respective titles.

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INDIA, PORTUGUESE. Possessions of Portugal in India, comprising Goa, Daman, and Diu. (See these respective titles.) Area, 1558 square miles. Population, in 1881, 420,868; in 1894, 494,836. For history, see under INDIA; EAST INDIA COMPANY; DIAS; GAMA; ALMEIDA; and CASTRO.

INDIA INK. A black pigment, formed by mixing lampblack and gum into a paste and then pressing it into molds where it dries into sticks of various shapes. It was originally made in China and Japan, and the best grades are still produced in those countries, the common lampblack of Occidental countries being too coarse for many purposes. It is said that the Chinese collect the lampblack used in its manufacture from the oil of sesame. In China India ink is applied with a brush, both for writing and painting. In Europe and America it is chiefly used for black-and-white drawings, it being possible to regulate the depth of the shade by the amount of water used in mixing the ink. India ink is the only true black ink produced, all other grades having a tinge of some other hue.

INDIA MUSEUM. A collection in London, illustrating the antiquities, history, and resources of India. In 1880 it was placed under the management of the South Kensington Museum, and has been much enlarged.

INDIANA. 'The Hoosier State.' One of the North Central States of the American Union; bounded on the north by Lake Michigan and the State of Michigan, on the east by Ohio, on the south by the Ohio River, separating it from Kentucky, and on the west by Illinois. It lies between latitudes 37° 47′ and 41° 50′ N. and longitudes 84° 49′ and 88° 2′ W. The extreme length is 277 miles; greatest breadth, 145 miles; area, 36,350 square miles, of which 440 square miles are water.

TOPOGRAPHY. Indiana resembles Illinois in its physical features. Lying within the prairie region, it has a gently undulating surface which slopes by imperceptible stages toward the southwest. The northeastern part has an elevation of 1000 to 1200 feet, the northwestern 500 to 700 feet; along the Ohio River the elevations are about 500 feet in the southeast and 300 feet in the southwest. There are sandy hills near Lake Michigan, and a series of low elevations of glacial origin occurs in the southern part, extending from the Ohio, in Clark County, northwestward to Parke County on the Wabash. A portion of northern Indiana is drained into the Mississippi through the Kankakee and Illinois, into Lake Michigan through the Calumet and Saint Joseph, and into Lake Erie through the Maumee, but most of the streams have a southerly or southwesterly course into the Ohio and Wabash. The last-named rises in western Ohio, and crossing northern Indiana it is joined by the Salamonia, Mississinewa, Wild Cat, Eel, and Tippecanoe. Near the western border the Wabash receives the Vermilion from Illinois, while its most important tributary, White River, joins it 50 miles above the confluence with the Ohio. The southern border is drained directly into the Ohio through the White Water, Blue, Little Pigeon, and other short streams. There are several small lakes in northern Indiana, the largest being English Lake on the headwaters of the Kankakee.

CLIMATE AND SOIL. The mean annual temperature for the State is about 52° F., ranging from 48° in the northern to 56° in the southern counties. Cold northerly winds lower the winter temperatures to an extreme of —25°. At Indianapolis the thermometer shows an average temperature of 28° for January, and 76° for July. The mean rainfall for the year over the whole State is about forty-three inches. With the exception of sandy areas around Lake Michigan, the soil is generally fertile, and some of it remarkably so. In the northern and central parts the soil is composed of drift materials, more or less assorted by water action into beds of sand and clay. Without the drift region in the southern tier of counties, the soil has been derived by weathering of sandstones and limestones, and is generally less fertile than that of the prairies. The richest soils are found in the river valleys, particularly in those of the Wabash and the White Water.

Flora and Fauna. See these topics under United States.

Geology. The geological relations are greatly obscured by the heavy covering of glacial materials. North of the Wabash the prevailing strata are of Devonian age and mostly limestones. The eastern part of the State between the Ohio and the Wabash is underlain by Silurian and the western by Carboniferous rocks.

Mineral Resources. The coal-fields of Indiana cover an area of 6500 square miles in the western and southwestern counties. They are of Carboniferous age and yield bituminous coal suitable for heating. The chief producing counties are Clay and Vigo, each with an annual output of more than 1,000,000 tons, and Sullivan, Vermilion, Greene, and Parke counties. The total output in 1901 was 6,918,225 short tons, valued at $7,017,143. Petroleum, one of the most valuable products of the State, is found in the Lima district of Adams, Wells, Jay, Blackford, and Grant counties. From 1889 to 1901 inclusive, the output was 38,355,000 barrels; in the last year it amounted to 5,757,086 barrels, valued at $4,822,826. Natural gas is obtained in many of the central counties, including Hancock, Henry, Hamilton, Tipton, Madison, Grant, and Delaware, the area of the field being about 3000 square miles. In 1901 there were 4600 wells in operation, and the output was valued at $6,954,566. A large quantity of gas is transported to Chicago. Indiana has a valuable quarry industry, producing sandstones and limestones suited for building and ornamental purposes. The Bedford oölitic limestone, which comes from southern Indiana, is one of the best-known building-stones in the country. Brick-clays are widely distributed, and marls adapted to the manufacture of hydraulic cement are found along the Ohio River.

Agriculture. According to the census of 1900, 94.1 per cent. of the land area of the State was included in farms. The farm area increased in every decade but one—1880 to 1890—of the last half of the nineteenth century, making a total gain in the half-century of 69 per cent. In the same period the improved land increased more than twofold, amounting, in 1900, to 77.2 per cent. of the total farm area. The most extensive non-arable lands are in the hilly region of the south-central section, and in the swamp lands of the northern part. Formerly the land that was too wet for successful cultivation constituted in the aggregate a very considerable portion of the total area, but by an extensive system of drainage the greater part of it has been reclaimed, and now constitutes the most productive land in the State. The average size of farms had decreased from 136.3 acres in 1850 to 97.4 acres in 1900, every decade of that period having witnessed a decrease. The rented farms amount to 28.6 per cent. of the total number, over four-fifths of which are rented according to the share system.

Agriculture has the advantage of a very superior system of railroad transportation, and of numerous city markets within the State. Besides, proximity to such great centres in adjoining States as Chicago, Cincinnati, and Louisville opens up a wider field. Indiana is not divided into crop belts, nor does any one crop have a monopoly. The three-crop rotation system is commonly in vogue, and for a long time the State was one of the leaders in the production of corn, wheat, and hay (timothy and clover). Recently, with the great development of some of the Western States, that place has been lost, though a high rank is still held. The census for 1900 showed a larger acreage for corn, wheat, and hay than was reported at any previous census. Potatoes and oats are grown everywhere, but in somewhat larger quantities in the northern part of the State. Barley, buckwheat, and rye are raised, but not in large quantities. All kinds of fruits and vegetables common to the temperate zone are raised. Much attention is being given to the production of tomatoes for canning, and no other State west of the Alleghany Mountains equals Indiana in this respect. Of the total number of orchard trees, apple-trees (8,624,593) constitute 61.1 per cent. Large quantities of peaches are grown in some of the southeastern counties. The number of peach, pear, and plum trees each more than trebled during the decade ending with 1900.

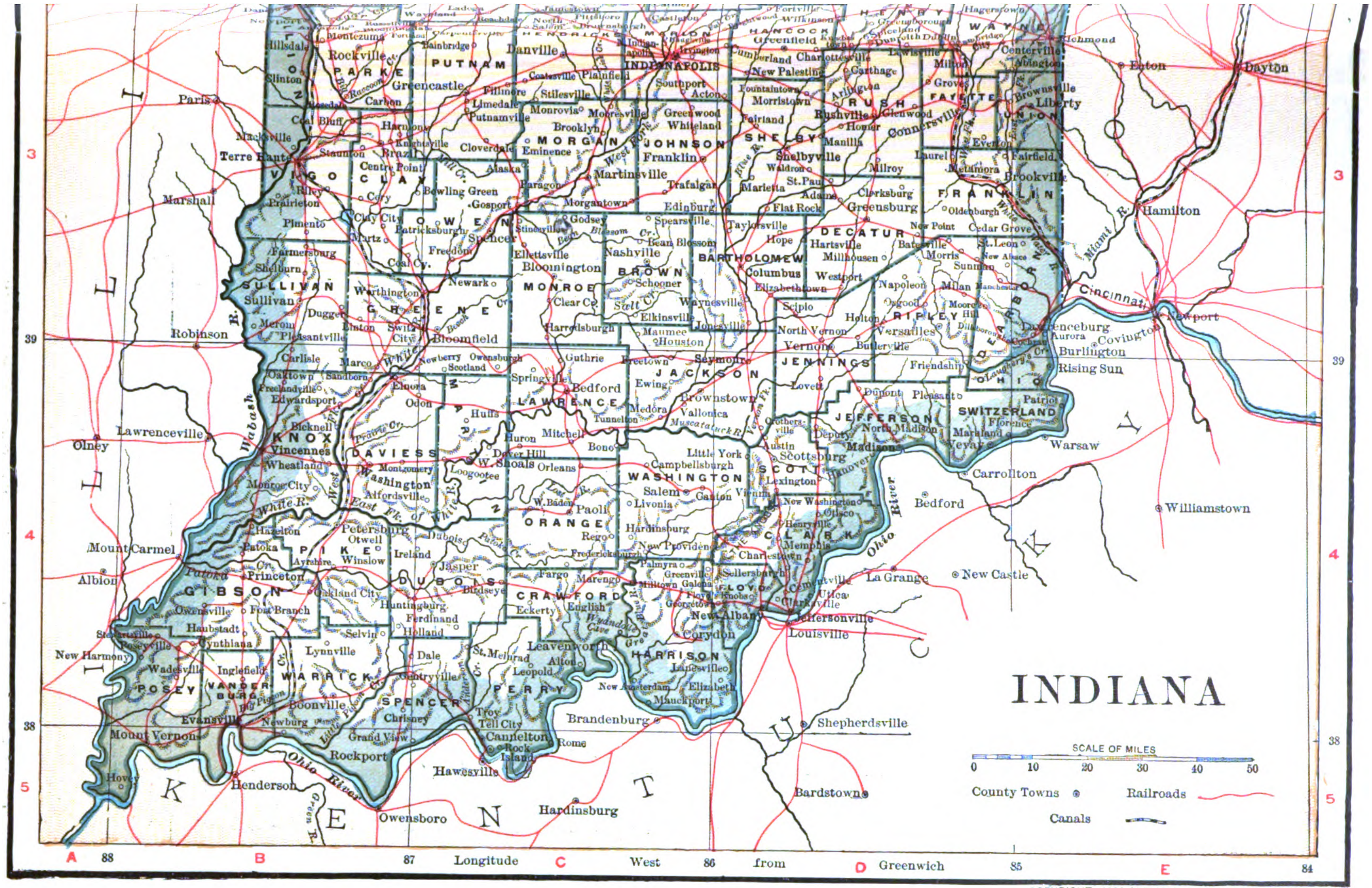
Stock-Raising. Stock-raising is important, attention being evenly divided between horses, cattle, and swine. Every decade since 1870 has witnessed an increase in the number of all varieties of farm animals except sheep, which suffered a corresponding decrease. (The decrease shown in the table in the number of dairy cows is due to a change in the method of enumeration, and is, therefore, only apparent.) Sheep-raising is largely confined to the northeastern part of the State. In 1899, $8,027,370 was realized from the sale of dairy products, about half of which was from sales of butter and the remainder principally from sales of milk. The receipts from poultry products are also very large. The following tables, taken from the census returns of 1890 and 1900, show the relative importance of the different crops and varieties of farm animals and the changes which have occurred during the decade:

CROP (acres)	1900	1890
Corn	4,499,249	3,586,190
Wheat	2,893,293	2,570,017
Oats	1,017,385	1,102,479
Rye	43,562	62,890
Hay	2,442,414	2,330,504
Potatoes	84,245	113,509

LIVE STOCK	1900	1890
Dairy cows	574,276	579,287
Other neat cattle	1,110,202	932,621
Horses	751,715	720,035
Mules and asses	67,725	59,644
Sheep	1,010,648	1,081,133
Swine	3,763,389	3,320,817

AREA AND POPULATION OF INDIANA BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Adams	D 2	Decatur	335	20,181	22,232
Allen	D 1	Fort Wayne	660	66,689	77,270
Bartholomew	D 3	Columbus	400	23,867	24,594
Benton	B 2	Fowler	410	11,903	13,123
Blackford	D 2	Hartford City	167	10,461	17,213
Boone	C 2	Lebanon	427	26,572	26,321
Brown	C 3	Nashville	317	10,308	9,727
Carroll	C 2	Delphi	370	20,021	19,953
Cass	C 2	Logansport	420	31,152	34,545
Clark	D 4	Jeffersonville	375	30,259	31,835
Clay	B 3	Brazil	357	30,536	34,285
Clinton	C 2	Frankfort	402	27,370	28,202
Crawford	C 4	English	304	13,941	13,476
Daviess	B 4	Washington	430	26,227	29,914
Dearborn	E 3	Lawrenceburg	309	23,364	22,194
Decatur	D 3	Greensburg	384	19,277	19,518
Dekalb	D 1	Auburn	369	24,307	25,711
Delaware	D 2	Muncie	395	30,131	49,624
Dubois	C 4	Jasper	425	20,253	20,357
Elkhart	D 1	Goshen	465	39,201	45,052
Fayette	D 3	Connersville	215	12,630	13,495
Floyd	D 4	New Albany	150	29,458	30,118
Fountain	B 2	Covington	383	19,558	21,446
Franklin	D 3	Brookville	394	18,366	16,388
Fulton	C 1	Rochester	363	16,746	17,453
Gibson	B 4	Princeton	490	24,920	30,099
Grant	D 2	Marion	416	31,493	54,693
Greene	B 3	Bloomfield	482	24,379	28,530
Hamilton	C 2	Noblesville	402	26,123	29,914
Hancock	D 3	Greenfield	290	17,829	19,189
Harrison	E 4	Corydon	470	20,786	21,702
Hendricks	C 3	Danville	408	21,498	21,292
Henry	D 3	Newcastle	395	23,879	25,088
Howard	C 2	Kokomo	295	26,186	28,575
Huntington	D 2	Huntington	385	27,644	28,901
Jackson	C 4	Brownstown	520	24,139	26,633
Jasper	B 1	Rensselaer	565	11,185	14,292
Jay	D 2	Portland	370	23,478	26,818
Jefferson	D 4	Madison	362	24,507	22,913
Jennings	D 4	Vernon	380	14,608	15,757
Johnson	C 3	Franklin	312	19,561	20,223
Knox	B 4	Vincennes	510	28,044	32,746
Kosciusko	D 1	Warsaw	521	28,645	29,109
Lagrange	D 1	Lagrange	393	15,615	15,284
Lake	B 1	Crownpoint	465	23,886	37,892
Laporte	C 1	Laporte	563	34,445	38,386
Lawrence	C 4	Bedford	460	19,792	25,729



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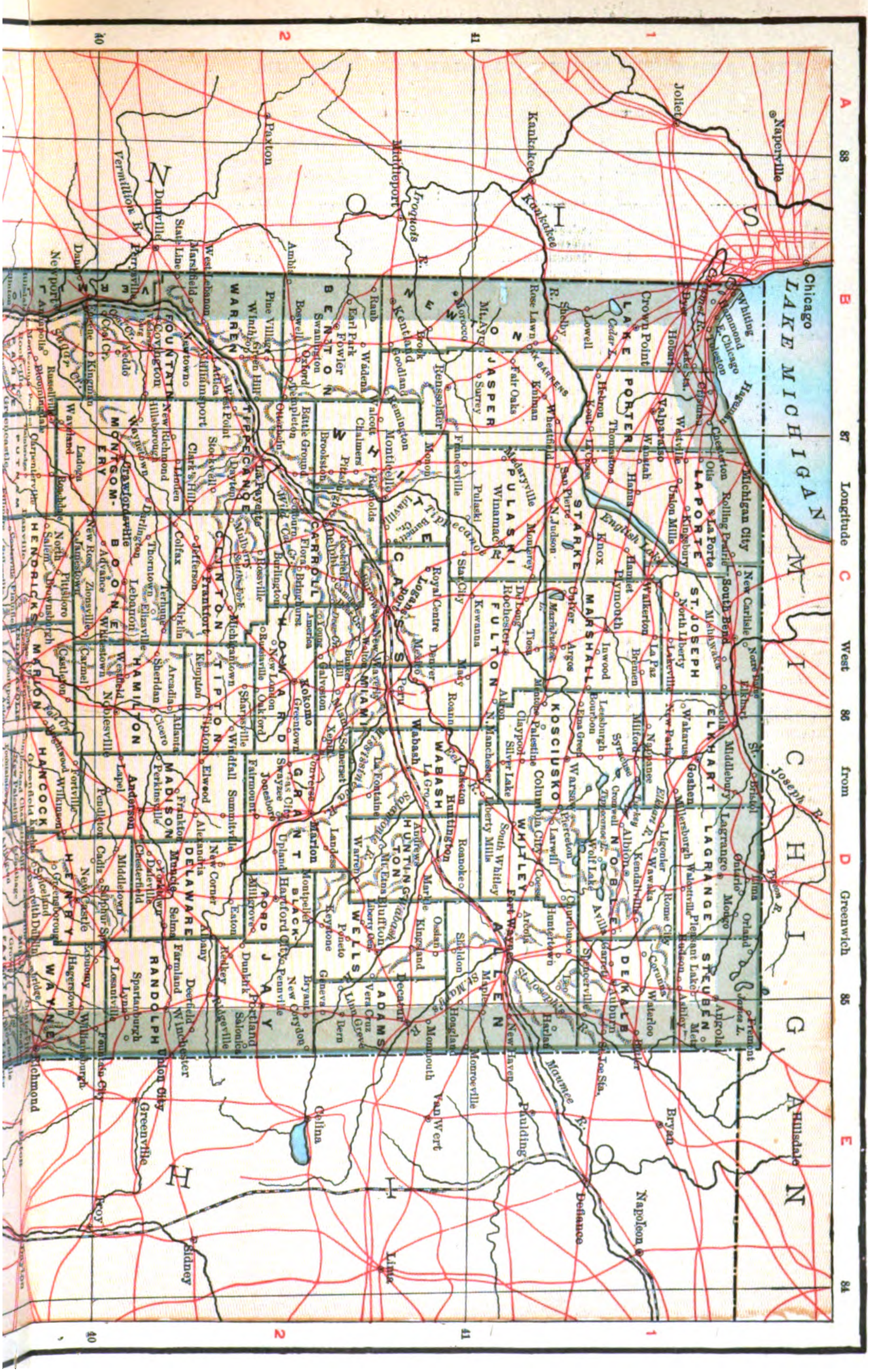

Longitude West from Greenwich
88
87
86
85
84
40
41
1
2
A
B
C
D
E
LAKE MICHIGAN
MICHIGAN
ILLINOIS
OHIO
Chicago
Naperville
Joliet
Kankakee
Paxton
Danville
Hillsdale
Bryan
Napoleon
Defiance
Paulding
Van Wert
Lima
Celina
Sidney
Greenville
Union City
Troy
Richmond
LAKE
PORTER
LA PORTE
ST. JOSEPH
ELKHART
LAGRANGE
STEUBEN
DE KALB
NOBLE
KOSCIUSKO
MARSHALL
STARKE
JASPER
NEWTON
BENTON
WHITE
PULASKI
FULTON
CASS
CARROLL
MIAMI
WABASH
HUNTINGTON
WHITLEY
ALLEN
ADAMS
WELLS
GRANT
HOWARD
TIPTON
CLINTON
TIPPECANOE
WARREN
FOUNTAIN
MONTGOMERY
BOONE
HAMILTON
MADISON
DELAWARE
BLACKFORD
JAY
RANDOLPH
HENRY
WAYNE
HANCOCK
MARION
HENDRICKS
South Bend
Fort Wayne
Michigan City
Valparaiso
Crown Point
Plymouth
Warsaw
Logansport
Lafayette
Kokomo
Marion
Muncie
Anderson
Frankfort
Crawfordsville
Lebanon
Noblesville
Peru
Wabash
Huntington
Goshen
Elkhart
Kankakee R.
Tippecanoe R.
Wabash R.
Maumee R.
St. Joseph R.

AREA AND POPULATION OF INDIANA BY COUNTIES.

(*Continued.*)

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Madison	D 2	Anderson	460	36,487	70,470
Marion	C 3	Indianapolis	400	141,156	197,227
Marshall	C 1	Plymouth	440	23,818	25,119
Martin	C 4	Westshoals	340	13,973	14,711
Miami	C 2	Peru	375	25,823	28,344
Monroe	C 3	Bloomington	414	17,673	20,873
Montgomery	C 2	Crawfordsville	508	28,025	29,388
Morgan	C 3	Martinsville	415	18,643	20,457
Newton	B 2	Kentland	380	8,803	10,448
Noble	D 1	Albion	417	23,359	23,533
Ohio	D 4	Risingsun	87	4,955	4,724
Orange	C 4	Paoli	400	14,678	16,854
Owen	C 3	Spencer	380	15,040	15,149
Parké	B 3	Rockville	453	20,296	23.000
Perry	C 4	Cannelton	383	18,240	18,778
Pike	B 4	Petersburg	336	18,544	20,486
Porter	B 1	Valparaiso	418	18,052	19,175
Posey	B 4	Mount Vernon	410	21,529	22,333
Pulaski	C 1	Winamac	437	11,233	14,033
Putnam	C 3	Greencastle	482	22,335	21,478
Randolph	D 2	Winchester	450	28,085	28,653
Ripley	D 3	Versailles	447	19,350	19,881
Rush	D 3	Rushville	406	19,034	20,148
St. Joseph	C 1	South Bend	560	42,457	58,881
Scott	D 4	Scottsburg	190	7,833	8,307
Shelby	D 3	Shelbyville	408	25,454	26,491
Spencer	B 4	Rockport	406	22,060	22,407
Starke	C 1	Knox	314	7,339	10,431
Steuben	D 1	Angola	311	14,478	15,219
Sullivan	B 3	Sullivan	440	21,877	26,005
Switzerland	D 4	Vevay	225	12,514	11,840
Tippecanoe	C 2	Lafayette	488	35,078	38,659
Tipton	C 2	Tipton	260	18,157	19,116
Union	E 3	Liberty	162	7,006	6,748
Vanderburg	B 4	Evansville	236	59,809	71,769
Vermillion	B 2	Newport	255	13,154	15,252
Vigo	B 3	Terre Haute	402	50,195	62,035
Wabash	D 2	Wabash	418	27,126	28,235
Warren	B 2	Williamsport	366	10,955	11,371
Warrick	B 4	Boonville	397	21,161	22,329
Washington	C 4	Salem	523	18,619	19,409
Wayne	E 3	Richmond	409	37,628	38,970
Wells	D 2	Bluffton	367	21,514	23,449
White	C 2	Monticello	500	15,671	19,138
Whitley	D 2	Columbia City	336	17,768	17,328

MANUFACTURES. Indiana is somewhat less fortunate than some of its sister States in respect to natural facilities of transportation and the possession of cities favorably situated to draw trade. It has no manufacturing centres of the first rank. Nevertheless, the highly developed state of railroad transportation gives Indiana an easy access to the markets of the country; and this, together with the superior resources of the State, is resulting in a rapid development of manufacturing. In 1900 there were 155,900 wage-earners engaged in manufactures, an increase of 41 per cent. for the decade ending with that year, as against an increase of 59.1 per cent. for the preceding decade. The percentage of the population engaged in manufacturing grew from 3.5 in 1880 to 5.0 in 1890 and 6.2 in 1900. Among the factors which are accountable for this recent growth, the most important is the development of the natural-gas resources of the State. From about 1886 the production of gas increased steadily until 1899, when it exceeded in amount that of any other State. The nature of this fuel confines its use to the region of production and to the immediately surrounding territories, where it may be secured by piping. Consequently, its benefits have been greatest to such towns as Elwood, Anderson, Muncie, and other places located in the natural-gas belt. The industries which have been attracted to this district are those which require an abundance of cheap fuel, such as iron and steel and glass manufactures. These two industries now take rank among the most important of the State, the increase of each during the decade 1890 to 1900 being respectively 307 and 392 per cent. The Indiana glass-factories now send shipments to Norway and New Zealand.

The manufacture of tin and terne plate has developed as a branch of the iron and steel industry. Another group of industries, and one that includes the three most important manufactures of the State, owes its development to the abundant local agricultural resources. Wheat and corn respectively give rise to the flour-milling and the distilling industries; and the feeding of stock, especially hogs, is largely responsible for the development of an important slaughtering industry. From the table appended it will be seen that there has been a slight decrease in the value of the flouring and grist mill products; but this is due to the decline of prices rather than in the amount of the output of the mills. The value of the production of liquors and of slaughtering and meat-packing products, on the contrary, increased respectively 134.9 and 57.1 per cent. Three-fourths of the liquors produced are distilled. The distilling interests are centred largely in Terre Haute. The slaughtering and meat-packing industry is the most extensive at Hammond (not far from Chicago) and at Indianapolis. During the decade 1890 to 1900 there was a decided decrease in wholesale slaughtering, not including meat-packing. This decrease has been much more than counterbalanced by the growth in that branch of the industry which includes meat-packing.

Another important group of manufactures has developed as a result of the extensive local timber resources. The forests contain valuable hard-wood timbers, which are extensively used in the manufacture of carriages and wagons, furniture, and agricultural implements. South Bend is noted for the manufacture of carriages and wagons. To the supplies of hard-wood also is partially due the prominence attained in car-construction. The wood-pulp industry is likewise dependent upon the forests for its raw materials. Although the resources of the forests are rapidly diminishing, the industries which depend upon forest products continue to thrive, the necessary supplies being obtained from the adjoining States to the north and the south. Among other industries the manufacture of foundry and machine-shop products is the most important. The gain during the decade amounted to 80.5 per cent. The printing and publishing output and the manufacture of pottery, terra-cotta and fire-clay products also showed decided gains during the decade. The census figures on the next page show the relative importance of the leading industries for the years indicated.

TRANSPORTATION. Indiana's natural means of transportation consists of the Ohio River, forming the entire southern boundary of the State; its tributary, the Wabash, navigable at high water as far as Lafayette; and Lake Michigan on the north, with the single port of Michigan City. The National Road, running east and west through the central part of the State, played an important part during the pioneer period, as did also two canals—one, the Wabash and Erie, entering the State at the northeast corner and running diagonally across it to Evansville in the southwest corner; the other, the White Water Canal, extending from Lawrenceburg in the southeast corner of the State, north to Hagerstown. But these have been superseded by railroads, and for a number of years have been abandoned. Railroads have come to be the principal means of communication, the State being most advantageously placed in this respect. All lines from the east centring in Chicago pass through the State, as do most of the lines connecting the great commercial centres of the East with those of the West, besides some important northern and southern lines. Of a total mileage of 6459, less than 1000 miles of road have terminals within the State. There are 19 miles of railroad per 100 square miles of territory, and 24.91 miles for every 10,000 inhabitants. Recently there has been a remarkable development of cross-country electric car lines, and apparently these will become common in districts where local passenger traffic is great, or where railroad accommodations are wanting. Indiana has, in addition to one port of entry, two ports of delivery, Evansville and Indianapolis.

BANKS. In 1902 there were 145 national banks in the State. Their capital stock was $16,774,000; cash, etc., $8,998,000; loans, $62,453,000; and deposits, $76,079,000. There were 110 State banks with a capital of $4,914,000; cash, $1,618,000; loans, $17,991,000; and deposits, $23,316,000. There were 68 private banks with a capital of $1,639,000; cash, $659,000; loans (not including loans on real estate and other collateral security), $5,472,000; and deposits, $9,692,000. In the savings banks of the State there were $6,561,600 deposits, the average deposit being $267.93.

GOVERNMENT. Indiana has its second Constitution, the present one having been ratified by a vote of the people in 1851. An amendment may be proposed by either House, and after being approved by a majority of the members elected to each House of two consecutively chosen assemblies

INDUSTRIES	Year	Number of establishments	Wage-earners, average number	Value of products, including custom work and repairing
Total for selected industries for State	1900	5,441	98,470	$247,207,994
	1890	4,920	75,564	165,736,153
Increase, 1890 to 1900	....	521	22,906	$81,471,841
Per cent. of increase	....	10.6	30.3	49.2
Per cent. of total of all industries in State	1900	30.2	63.1	65.4
	1890	39.8	68.3	73.1
Glass	1900	110	13,015	14,757,883
	1890	21	3,010	2,995,409
Iron and steel	1900	27	7,579	19,338,481
	1890	15	2,648	4,742,760
Flouring and grist mill products	1900	897	2,124	30,150,766
	1890	723	2,785	31,239,627
Liquors.				
Total	1900	66	1,281	22,738,105
	1890	54	1,032	9,677,973
Slaughtering.				
Total	1900	36	3,597	43,862,273
	1890	21	2,107	27,913,840
Lumber and timber products	1900	1,849	9,503	20,613,724
	1890	1,633	15,021	20,278,023
Lumber, planing-mill products, including sash, doors, and blinds	1900	205	2,115	5,088,669
	1890	178	2,122	4,787.974
Paper and wood pulp	1900	39	1,816	4,170,497
	1890	29	805	1,776,016
Agricultural implements	1900	45	3,419	6,415,081
	1890	54	3,078	5,756,131
Carriage and wagon materials	1900	61	2,289	3,149,588
	1890	38	1,856	2,282,810
Carriages and wagons	1900	275	6,490	12,742,243
	1890	394	4,508	8,248,873
Cars and general shop construction and repairs by steam-railroad companies	1900	54	8,081	10,242,422
	1890	48	6,613	7,289,382
Cars, steam railroad, not including operations of railroad companies	1900	4	3,337	9,006,577
	1890	4	3,310	7,073,329
Furniture, factory product	1900	129	7,149	8,769,509
	1890	131	6,096	7,662,650
Foundry and machine shop products	1900	337	10,339	17,228,096
	1890	206	5,904	9,542,499
Printing and publishing, newspapers and periodicals	1900	638	4,084	6,093,191
	1890	505	2,628	3,589,513
Clay products:				
Total	1900	607	4,859	4,222,529
	1890	784	5,926	3,142,454
Clothing, men's, factory product	1900	31	2,908	3,367,831
	1890	22	1,874	2,570,179
Textiles:				
Total	1900	31	4,485	5,250,529
	1890	60	4,241	5,166,711

it becomes a part of the Constitution. Voters must be twenty-one years of age, and have resided in the State six months, the township sixty days, and the ward or precinct thirty days. General elections are held on the first Tuesday after the first Monday in November; the time of holding township elections is determined by law.

LEGISLATIVE. The Senate cannot exceed fifty, nor the House of Representatives one hundred members. The former are elected for four, and the latter for two years, from districts composed of contiguous counties, and no county can be divided for Senatorial apportionment. The regular sessions of the Legislature meet biennially on the Thursday after the first Monday of January in odd years, but the time of meeting may be changed by law. If an organization of either House is not effected in five days, compensation to the members of such House stops until its organization has been accomplished. Ordinary sessions are limited in length to sixty-one days, and special sessions to forty days. Revenue bills must originate in the Lower House.

EXECUTIVE. The Governor and Lieutenant-Governor are elected for four years, the former being eligible but for four in any period of eight years. A majority of the members in the two Houses may override the Governor's veto. Bills sent to the Governor become law if not returned within three days. The Governor exercises the usual pardoning power, subject to legal regulations. A secretary, auditor, and treasurer are elected for two years.

JUDICIAL. The Superior Court judges (from three to five) are elected for six years from districts by the State at large. A clerk of the Superior Court is elected for four years. The State is divided into judicial circuits, in each of which a judge is elected to serve six years, but the law makes it possible for a judge elected on one circuit to hold court in another. A prosecuting attorney is elected in each judicial circuit for two years. Justices of peace are elected in townships for four years. Other courts or tribunals of conciliation may be established by law.

LOCAL GOVERNMENT. At the general elections each county elects a clerk of the Circuit Court, auditor, and recorder to serve four years each, and a treasurer, sheriff, coroner, and surveyor to serve two years each. A new system of local government aiming at a more complete separation of the executive and legislative functions became operative in 1899. Legislative boards are elected for each of the townships and for the county as a whole. They control expenditure and the levying of taxes. The local executive officers cannot create debts without the permission of these legislative bodies.

FINANCE. In January, 1901, the total State debt amounted to $4,504,615. Of this $1,085,000 cannot be paid off until 1915, and $144,000 cannot be paid off until 1937, and bonds held by Purdue University representing an additional $340,000 run perpetually. In October, 1901, there was a balance in the treasury of $611,649. For finance of education and charitable and penal institutions, see paragraphs under those headings.

POPULATION. In one or two respects Indiana differs much from other Northern States in point of population. It has been less affected by immigration, the native-born population being proportionally greater than that of any other Northern State. Furthermore, the population is peculiar in that a large per cent. came from the South—Kentucky, North Carolina, and Virginia—while generally being unaffected by the westward wave from New England and New York. Again, the proportion of urban population—30.6 per cent. in cities of only 4000 inhabitants (1900)—is less than that of any other of the Northwest Territory States. Of the 146,000 foreign born, the Germans constitute about one-half. The following shows the growth of population: In 1800, 2517; 1820, 147,178; 1840, 685,866; 1860, 1,350,428; 1880, 1,978,301; 1890, 2,192,404; 1900, 2,516,462—males, 1,285,404; females, 1,231,058; colored, 57,960. Indianapolis (the capital) in 1900 had 169,164; Evansville, 59,007; Fort Wayne, 45,115; Terre Haute, 36,673; South Bend, 35,999.

The State has thirteen Representatives in the National House of Representatives.

RELIGION. The Methodists from the pioneer days to the present have been the leading denomination, having more members in Indiana in proportion to the total State membership of all churches than in any other Northern State. In recent years the Christian Church has had a phenomenal growth. The Catholics are proportionally weaker than in any other Northern commonwealth. Altogether 55 different denominations are represented. Besides those mentioned, the most important are the Lutherans, Baptists, Presbyterians, United Brethren, and Friends.

EDUCATION. In recent years the educational status of Indiana has improved very rapidly. The percentage of illiteracy for the age period of ten years and over decreased from 7.5 per cent. in 1880 to 4.6 per cent. in 1900. The percentage of illiteracy of the colored population was 22.6. In 1899 there was 73 per cent. of all persons between the ages of six and twenty-one enrolled in the State schools, as against 71 per cent. in 1879, and the per cent. of attendance on the basis of enrollment increased during the same period from 61 per cent. to 76 per cent. This increase is partially the result of the recent compulsory education laws, which compel children between the ages of six and fourteen to attend the full term of the local school. The average length of the school term increased from 132 days in 1879 to 152 in 1900. A State law now requires a minimum term of six months, but there is still a decided contrast between the average length of the rural and the city schools. A carefully graded system is now universal throughout the State, and through the agency of a competent corps of county superintendents an efficient supervision of schools is effected. A serious problem has arisen in consequence of the very general decrease in the attendance at the rural schools. In 1899 there were 1848 schools having less than 15 pupils each. The solution of the problem is being found in the abandonment of the small schools and the transportation of the pupils to one centrally located school.

The greatest progress has been made in the high-school system of the State. Township high schools are now common. In 1899 there were 717 high schools, with courses of from two to four years in length, and 150 other schools in which some high-school work was done. High schools giving four-year courses and maintaining a certain standard of proficiency are granted commissions upon the approval of the State Board of Education. In the above year there were 156 commissioned high schools.

A considerable number of the teachers of the State have received collegiate and normal-school training. A more satisfactory system of examinations for teachers' certificates has been introduced, extending the jurisdiction of the State in the granting of certificates. At present life licenses are granted by the State Board of Education, as are also licenses for eight years and for sixty months. State licenses are issued by the State superintendent of public instruction for periods ranging from sixty to twelve months in length, while the county superintendent issues certificates for terms of from thirty-six to six months. The State maintains a normal school at Terre Haute, which in 1900 had an enrollment of 1672. Among the private normal schools are the Northern Indiana Normal School, at Valparaiso; the Tri-State Normal, at Angola; Rochester Normal University, at Rochester; and the Eastern Indiana Normal University, at Muncie. In 1900 the total number of male teachers was 7208; female, 8409.

The total expenditure for schools in 1900 was $8,188,089, of which $4,800,965 went to teachers and superintendents. A comparative study of the last few decades of the nineteenth century shows that the rate of the State tax for common schools is decreasing, necessitating heavier local burdens, the sum raised by local taxes having increased fourfold during that period ($2,542,552 in 1899). It is also found that the per capita cost of education has greatly increased in the rural districts and decreased in the cities. Indiana has fortunately provided a large permanent school fund, amounting in 1900 to $10,359,959. Of this $2,467,655, called the Congressional Township Fund, was secured from the sale in each township of the sixteenth section of land. The remainder ($7,892,303), called the Common School Fund, is composed of the county seminary fund, saline fund, bank-tax fund, surplus-revenue fund, and the sinking fund.

Higher education is provided by the State University at Bloomington, and technical instruction by Purdue University at Lafayette. There are numerous higher denominational institutions, including De Pauw University (Methodist), at Greencastle; Notre Dame University (Roman Catholic), near South Bend; Indianapolis University (including Butler College, Christian); Earlham College, at Richmond (Friends); Wabash College, Crawfordsville; Hanover College (Presbyterian); and Franklin College (Baptist). Vincennes University, at Vincennes, and Rose Polytechnic Institute, at Terre Haute, are non-sectarian.

Charitable and Penal Institutions. Indiana has only recently begun a serious study of correctional and charitable problems. Formerly the township trustees distributed alms without let or hindrance, the burden of which was borne by the county. At present the township bears the expense of caring for its own poor, outdoor relief is discouraged, and uniform and detailed reports are made to county and State officers. Judges of the Circuit Court are now authorized to appoint boards of county charity, whose members are unsalaried. The State has pursued a policy of placing children in families rather than retaining them in institutions, and all children not defectives have been removed from the poor asylums. In 1900 the number of children in orphans' homes was 1682. The former prison at Jeffersonville has been transformed into a reformatory for first-offense cases, and is conducted very much on the 'Elmira' plan. The State has a parole law. There is a State board of charities appointed by the Governor, which has the power to investigate and supervise the charitable and correctional institutions of the State. These institutions are as follows: Hospitals for the insane at Richmond, Logansport, Evansville, and Indianapolis; a State Soldiers' Home, at Lafayette; School for the Deaf, Dumb, and Blind, at Indianapolis; School for Feeble-Minded Youths, at Fort Wayne; Soldiers' Orphans' Home, at Knightstown; Girls' Reform School, at Indianapolis; Boys' Reform School, at Plainfield; Woman's Prison, at Indianapolis; State prison, at Michigan City; and the State Reformatory, at Jeffersonville. Of these, all but the State prison are under the control of non-partisan boards. The expenditure incurred by these institutions in 1900 was $1,648,455, of which $1,290,790 was for maintenance. The earnings of the institutions for the same year amounted to $132,489. The expenditure for outdoor relief for the year ending in October, 1900, was $209,956, or only one-third as great as it was in 1895. The number of inmates (3096 in 1900) in the county poor asylums decreased relative to the total population during the same period. In 1900 the expenditure for gross maintenance of county poor asylums amounted to $345,496.

History. French trappers and fur-traders appeared within the present limits of Indiana as early probably as 1679. It is certain that La Salle, on his way to the Illinois Indians, crossed the northwestern part of the State by way of the Kankakee in 1680. The Miamis and Ouabachi (or Wabash) Indians then occupied the region, and welcomed the French, who built Fort Ouatanon, on the Wabash, in 1720, and Fort Vincennes in 1727. The first permanent settlement was founded in 1734-35, by a number of families who made their home in the neighborhood of Fort Vincennes. The population increased slowly; but, owing to the richness of the soil, the inhabitants (French entirely, together with negro and Indian slaves) enjoyed ease and great plenty. The territory came into the possession of England in 1763, but the English occupation was too brief to effect any change in the people or the laws. In 1778-79 George Rogers Clark (q.v.), with a handful of men, wrested the country from Great Britain. Hostilities with the Indians, continuing from 1781 to 1795, when a peace was conquered by General Wayne, brought great distress upon the settlers at Vincennes. In May, 1800, the Indiana Territory was organized, comprising all that portion of the Northwest Territory lying west and north of Ohio. Michigan and Illinois were subsequently set off, reducing Indiana to its present extent. The capital was moved from Vincennes to Corydon in 1813 and to Indianapolis in 1825. In 1811 Gen. William H. Harrison (q.v.), at the head of a force of regulars and militia, crushed the Indian tribes under the brother of Tecumseh at the battle of Tippecanoe (q.v.). When the war with England broke out the Indians renewed hostilities, but they were speedily subdued, and never more troubled the settlers. As in the case of Illinois, a large proportion of the immigrants into Indiana came from the South, and before 1816 repeated attempts were made to legalize slavery in the Territory, in spite of the ordinance of 1787. In 1816, the year of the State's admission into the Union, the question was definitely settled against slavery by the first constitutional convention, though a law prohibiting negroes and mulattoes from immigrating into the State remained in force till after the Civil War. The growth of the State in wealth and population was accelerated greatly by the construction of the National Road and the Wabash and Erie canals. Wild speculation in lands and railroads led to a general bankruptcy in 1837; but after 1846, when a compromise with the public creditors was effected, the economic and financial condition of the State improved steadily. Its prosperity since the Civil War has been due in great measure to the discovery of extensive coal, iron, and gas fields, and valuable deposits of building-stone, in different parts of the State. Conditions have been monotonously peaceful, except for spasmodic eruptions of mob violence, notably in the years 1869 and 1888, and the disorders around Hammond attending the great railway strike of 1894, when strikers and Federal troops came into conflict. As a result of the strike, a board of labor commissioners was created in 1897, to act as a permanent tribunal of arbitration. In the same year an anti-trust law and a factory-inspection law were passed, and primary education was made compulsory. For more than twenty years after 1878 the State balanced almost perfectly between the two great political parties, vacillating, in State elections especially, from side to side by minute majorities in a total vote of several hundred thousand. The opportunity for political manipulation was correspondingly great, and in national elections every device known to practical politics was brought into play to gain the electoral vote of the State. Law-making was carried on frequently in a partisan spirit, and it was a favorite manœuvre with the minority in the Legislature, Republican or Democrat, whenever it was hopelessly outnumbered on an important question, to resign in a body, so as to prevent a quorum and thus block legislation. In national elections the State was Democratic up to 1860, excepting in the years 1836 and 1840, when it cast its vote for William H. Harrison, the Whig candidate. It was Republican from 1860 to 1872, Democratic in 1876, 1884, and 1892, and Republican again in 1880, 1888, 1896, and

1900. The Governors, since its organization as a Territory, have been as follows:

	TERRITORIAL	
William H. Harrison		1800-1811
John Gibson		1811-1813
Thomas Posey		1813-1816
	STATE	
Jonathan Jennings,	Democrat-Republican,	1816-1822
William Hendricks,	" "	1822-1825
James B. Ray,	" "	1825-1831
Noah Noble,	" "	1831-1837
David Wallace,	Whig,	1837-1840
Samuel Bigger,	"	1840-1843
James Whitcomb,	Democrat,	1843-1849
Joseph A. Wright,	"	1849-1857
Ashbel P. Willard,	"	1857-1861
Henry S. Lane,	Republican,	1861
Oliver P. Morton	"	1861-1867
Conrad Baker,	"	1867-1873
Thomas A. Hendricks,	Democrat,	1873-1877
James D. Williams,	"	1877-1881
Albert G. Porter,	Republican,	1881-1885
Isaac P. Gray,	Democrat,	1885-1889
Alvin P. Hovey,	Republican,	1889-1891
Ira J. Chase,	"	1891-1893
Claude Matthews,	Democrat,	1893-1897
James A. Mount,	Republican,	1897-1901
Winfield T. Durbin,	"	1901-

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INDIANA. (1) A romance by George Sand (1832), and the name of the heroine, a young Creole, ignorant of the world and married to a husband much older than herself. Her love is gained by Raymon, a man of leisure, who, when she yields to his ascendency, refuses to compromise himself and repulses her offer. After Raymon's marriage and the death of her husband, she becomes the wife of an English lover. The novel was written after the author had separated from her husband, and voices her indignation at the results of ill-assorted marriages. *Indiana*, which was George Sand's first novel, had a great success from the social question involved and the intense individuality which the author put into her work. (2) A character in Steele's comedy, *The Conscious Lovers.*

INDIANA ASBURY UNIVERSITY. See DE PAUW UNIVERSITY.

INDIAN AFFAIRS. The position of the Indian tribes within the limits of the United States is anomalous. Strictly speaking, they are not a part of the body politic, but are regarded as 'domestic dependent nations,' and are officially spoken of as the 'wards' of the nation. So long as they maintain their tribal relations, their right to regulate their domestic affairs has been generally conceded. Recently this right has been restricted by acts of Congress enlarging the jurisdiction of the Federal courts in respect to crimes committed by Indians. The tribes inhabiting the Indian Territory, namely, the Cherokees, Chickasaws, Choctaws, Creeks, and Seminoles, are officially known as the 'five civilized tribes.' They have adopted the habits of civilized life and live under well-ordered governments. Each nation has its own popularly elected executive, legislature, and judiciary. They may enact such laws for the regulation of their internal affairs as do not conflict with the Constitution and laws of the United States, while the decisions of their courts receive the same recognition as to faith and credit as those of the Territories. The title to land occupied by them is not in the individual members of the tribe, but in the nation as a whole, and it can be alienated only with the consent of the Government. White men may become members of an Indian nation by adoption, and are then subject to the jurisdiction of the tribal courts, although they still retain their citizenship. The Supreme Court has held that an Indian born within the jurisdiction of a tribe can become a citizen of the United States only by naturalization. By an act of Congress, however, passed in 1887, it was provided that Indians residing on lands allotted to them in severalty should be considered as citizens of the United States without the formality of naturalization. The immediate effect of the act of 1887 was to confer citizenship upon 10,122 Indians to whom allotments had already been made under special laws and treaties. Every year from 1000 to 2000 Indians signify their desire of becoming citizens by taking allotments. The right of Indians to sue and be sued in both Federal and State courts is well recognized, and they are frequently given the right of suffrage by the States in which they reside. At the present time there are estimated to be over 20,000 Indian voters in the United States. The Constitution confers upon Congress the power to regulate commerce with the Indian tribes, and until the year 1871 the common method of dealing with them was by treaty through the agency of special commissioners. In that year, however, an act of Congress abolished this practice, and placed under the immediate control of Congress all commercial or diplomatic intercourse with the Indians.

From an early period it has been the practice of the Government to conclude treaties with the Indians for the extinction of their possessory right to the lands occupied by them and for their removal to certain territories specially set apart for their occupation. These lands are known as Indian reservations, the largest and most important of which at the present time is the Indian Territory (q.v.), created in 1834. Whenever the United States sets apart an Indian reservation, whether within the territorial limits of a State or not, it has full authority to protect the Indians in their persons and property and to provide for the punishment of all offenses committed within the reservation. An Indian reservation lying within the limits of a State is, however, subject to its jurisdiction also except so far as concerns the government and protection of the Indians themselves, unless otherwise provided by treaty with the Indians. While all territory officially known as 'Indian country' is subject to the jurisdiction of the United States, and while it belongs to Congress to enact laws for the regulation of intercourse of Indians with one another and with citizens of the United States, it is the policy of the Government to leave to the Indians the regulation of their own domestic concerns as far as practicable. By acts of 1885 and 1890 Congress curtailed the jurisdiction of the Indian tribal courts. By the act of 1885 the authority to administer their own criminal laws among themselves, so far as certain enumerated crimes committed by Indians are concerned, was withdrawn and vested in Territorial courts. By the act of 1890 the Federal courts were given jurisdiction of all civil cases in the Indian Territory except those over which the tribal courts have exclusive jurisdiction, and over all cases of contract between Indians and citizens of the United States, and all controversies between members of different tribes, as well as certain other cases specially enumerated. By the same act certain laws of Arkansas were extended over the Indian Territory. State courts have no jurisdiction over offenses committed by tribal Indians upon a reservation within the State.

It is the policy of the United States to exercise a general supervision over the affairs of the Indians and to protect them from the encroachments of unscrupulous whites, as well as from the evil consequences of their own ignorance and improvidence. Many statutes have been passed by Congress to prohibit hunting on their lands, to prevent cutting timber from their lands, or pasturing stock on them, to prevent the sale of intoxicating liquors to them, etc. Citizens of the United States of good moral character are permitted to trade with Indian tribes, upon giving bonds. The power of appointing and licensing Indian traders, as well as prescribing rules concerning the kind, quantity, and prices of goods to be sold, belongs to the United States Commissioner of Indian Affairs. This officer is further empowered to remove from Indian reservations all persons found there contrary to law or whose presence is deemed detrimental to the peace and good order of the Indians.

Until 1832 the supervision of Indian affairs was intrusted to a bureau in the War Department. In that year Congress authorized the President to appoint a commissioner charged with general superintendence of Indian affairs. He has the direction of eight inspectors and a large number of superintendents, agents, teachers, mechanics, etc. Since 1849 the business of Indian affairs has constituted a bureau in the Department of the Interior. The most numerous officials in the Indian service are the agents, appointed by the President for a term of four years, who are required to give bonds. Their duties are to superintend the intercourse among Indians within their respective agencies and to execute the orders of the commissioner. An important feature of the Indian service is the educational work. The President is empowered to employ capable persons to instruct the Indians in agriculture and to teach their children reading, writing, and arithmetic. By an act of 1882 he was authorized to appoint an inspector of Indian schools. The schools under Government control are the non-reservation training-schools and the reservation boarding and day schools. Besides these there are contract schools under the supervision of religious associations which receive Government aid. By an act of Congress passed in 1890, provision was made for field matrons who organize sewing-schools, weekly clubs, and Sabbath-schools among the Indians. In 1893 more than 21,000 Indian children were receiving the benefits of education, about two-thirds being enrolled in Government schools. The number of Indians occupying reservations is 134,476. The annual appropriation by Congress for the Indian service usually exceeds $10,000,000. The policy now being pursued by the Government will result in the incorporation of all Indians in the body politic as citizens, and with it the Indian reservations will disappear, the individuality of the Indian will be recognized, and the paternal care and control now exercised by the United States will cease.

Consult: *Annual Reports of the United States Commissioner of Indian Affairs;* Weil, *The Legal Status of the Indian* (New York, 1888).

IN'DIANAP'OLIS. The capital of Indiana and its largest city, and the county-seat of Marion County; on White River, in the centre of the State, 183 miles southeast of Chicago and 111 miles northwest of Cincinnati (Map: Indiana, C 3). It lies 700 feet above sea-level, in a broad, rolling plain. The surrounding region is rich in agricultural and mineral resources, and in forest trees of exceptional beauty. Large natural-gas and oil fields are tributary to it, and near by are coal-lands 7000 square miles in extent. Besides there are found in the vicinity of the capital building-stone, marl, iron, and other minerals. Wholly an inland city, Indianapolis relies on railways for its commerce. Within 50 miles of the centre of population of the United States for the past two decades, its location has made it a great railway centre. Here terminate seven divisions of the Big Four system, six divisions of the Pennsylvania Railroad, two divisions of the Cincinnati, Indianapolis and Western Railway, the Lake Erie and Western, and the Monon, besides ten interurban electric systems. The railways bring their passenger trains into a handsome union depot, and the interurban lines have contracted to erect a large union terminal station to cost over $1,000,000. Freight passing Indianapolis is carried over a belt railway, 15½ miles long. It encircles the city. The street-railway system represents an outlay of about $9,000,000, with 125 miles of tracks, and a park (Fairview) containing 200 acres.

The city is noted for the beauty of its streets, ranging from 40 to 120 feet in width, and shaded mainly by hard maples and elms, and crossing at right angles. In the heart of the city is a circular plaza, once known as 'the Governor's Circle,' and now called Monument Place, from which radiate four avenues to the four corners of the city. The park system comprises 1250 acres, and includes Riverside, extending for five miles along both sides of White River; the Indiana Central Canal and Fall Creek; Garfield, Brookside, Military, Saint Clair, and University parks, and Woodruff Place. The most notable structure in Indianapolis is the Soldiers and Sailors' Monument, designed by Bruno Schmitz, of Berlin. It was erected by the State to commemorate the part Indiana bore in the wars of the Union. The monument is a shaft of stone and bronze 285 feet in height, surmounted by a figure of Indiana Triumphant. About the base are allegorical groups in stone representing war and peace, and beneath these are two great fountains. Near the monument are four subsidiary bronze statues of Gen. George Rogers Clark, Gen. William Henry Harrison, Gov. James Whitcomb, and Oliver Perry Morton. There is also a statue of Schuyler Colfax in University Park, and in the Capitol grounds one of Thomas A. Hendricks. A large fund has been raised for a memorial to Benjamin Harrison. The buildings most worthy of note are the Capitol, 492 by 185 feet, built of Indiana limestone at a cost of $2,000,000; the court-house, city hall, Federal arsenal, new post-office (to cost $2,500,000), Christ Church, Manual Training High School and some of the common-school buildings, Columbia Club, Commercial Club, the Claypool Hotel, the Propylæum, a woman's building devoted to literary and social purposes, and, perhaps the finest of all, the public library, with 100,000 volumes. Three of the city's bridges possess more than ordinary beauty; they span Fall Creek at Illinois and Meridian streets and at Central Avenue, and are of stone.

Indianapolis is the seat of the University of Indianapolis, with an academic department known as Butler College, and departments of law, medicine, and dentistry. Here are also a Roman Catholic theological seminary, a negro Baptist college, a college under the control of the United Brethren Church, the Heron Art Museum and Art School, the State institutions for the education of the deaf and dumb and for the blind, a number of medical, dental, and law schools, etc. Public philanthropic institutions are numerous—a State reformatory for women, a State hospital for the insane, and many smaller hospitals, homes, and refuges for the sick and unfortunate. The public-school system includes, besides common schools, an academic high school and a manual-training high school, and a normal training-school. Its inventory of assets amounts to $2,398,766; its indebtedness (July 1, 1902), $868,000; its annual budget (1901), $934,337. Although far inland, Indianapolis is a port of entry and a point for the receipt and distribution of foreign as well as domestic commerce. Its chief articles of trade are grain and its products, live stock, meats, and the output of its extensive manufactories—milling machinery, engines, drugs, vehicles, furniture, bags, woolens, starch, and terra-cotta.

The government of the city is vested in a mayor, a council of twenty-one members (fifteen elected by wards and six at large), and a police judge, all chosen biennially. Appointments to the subordinate administrative departments are made by the Mayor. A school board of five, elected by popular vote and serving four years, governs an independent school corporation through an educational executive, the superintendent and a business executive (termed business director) each serving four years. The municipal budget (1901), including school expense, balances at about $2,700,000, the main items being: For fire department, $194,000; for police, $160,000; for parks, $100,947; for light, $113,273; for public health, $54,154; for water, $90,000. The tax valuation of all property, at perhaps three-fourths actual value, is $129,000,000, and the total debt of the city, exclusive of school debts, is about $2,300,000. Population, in 1850, 8091; 1860, 18,611; 1870, 48,244; 1880, 75,056; 1890, 105,436; 1900, 169,164. The population in 1900 included 17,100 foreign born and 15,900 negroes.

Settled in 1819, Indianapolis received its name in 1821, and became the capital on January 1, 1825, the seat of government being removed from Corydon. The opening of the first railroad in the State from Madison, on the Ohio River, occurred on October 1, 1847, and gave the little town its first impetus. The growth since 1889, when the introduction of natural gas revolutionized manufacture in Indiana, has been remarkable. Here Henry Ward Beecher served as pastor of the Second Presbyterian Church (1839 to 1847); Benjamin Harrison made Indianapolis his home from 1856 until his death, in 1901. Consult: *Indiana Gazetteer* (Indianapolis, 1849); Nowland, *Early Reminiscences of Indianapolis* (Indianapolis, 1870); Sulgrove, *History of Indianapolis and Marion County* (Philadelphia, 1884).

INDIAN ARCHIPELAGO, är'kĭ-pĕl'ȧ-gō. See MALAY ARCHIPELAGO.

INDIAN ARMY. See ARMIES, section on *British Empire,* and EAST INDIA ARMY.

INDIAN ART. India cannot compete with the peoples of Western Asia in the antiquity of its existing monuments, largely because the earliest constructions were of wood, as is shown by the report of Megasthenes, Greek Ambassador of King Seleucus (c.300 B.C.) to the Court of Pataliputra, who admired the vast halls of the wooden palace of the Indian King, with their gilded columns. Stone and brick came into use c.250 B.C., under Asoka, and here Indian architectural history begins. It falls into three main periods: (1) BUDDHIST (B.C. 300 to c.700 A.D.), in which architecture begins to decline in the fifth century; (2) NEO-BRAHMANIC, ruling alone, in harmony with Buddhism in certain regions, from A.D. 700 to 1000, and then dividing the field with the (3) MOHAMMEDAN style, which began with the Afghan invasion in the early eleventh century. Since the English conquest Indian architecture has lost all vitality. There is no unity in India under these periods or styles. Local differences are enormous. The two main geographical divisions are North India, which was the earlier to develop, and South India. At the same time Indian art as a whole has a very characteristic style. It far excels in architecture at least the art of China and Japan, and it governs the art of neighboring regions like Tibet, Cambodia, Burma, and Siam, and islands like Java and Ceylon, which owe their civilization to India.

ARCHITECTURE.

In seeking to explain the origin of Indian architecture, some traces of Greek influence have been found in the north, filtering through the Greek Kingdom of Bactriana, and visible in early monuments of Kabul and Kashmir in the Ghandara monasteries of Jamalgiri and Takht-i-bahi, and in India proper at the Amravati Stupa; but both Egypt, and especially Assyria, exercised far more fundamental influence, through the intermediary of Persia, which was flourishing when Indian art commenced. But whatever suggestions were received, they serve but to bring out the originality of Indian art, which stands at the antipodes of Greece in its exaggeration of forms, its multiplication of details, its love of complicated and confused lines. At the beginning comparative simplicity reigned, and it was not until long after the Christian Era that the richness of design was reached which remained characteristic. This was partly due to the use of brick, instead of stone or marble, in nearly all open-air structures before the tenth century A.D., which diminished the opportunity for elaborate surface ornamentation. The principal classes of monuments are the *chaityas*, or temples, the *viharas*, or monasteries, and the *stupas*, or mound sanctuaries. The temples are at first excavated in the rock; not until the fifth century were any built above ground (except that of Buddha Gaya), to judge from remaining examples.

BUDDHIST PERIOD. Of the earliest monuments, those of the Buddhist period, aside from the memorial columns or *lats* (e.g. those of Asoka), the important works were some thirty rock-cut temples and about a thousand monasteries, also cut out of the mountain-side. The temples are large, single, oblong halls, divided into nave and aisles by two rows of heavy columns, approached by a vestibule with an arched façade, richly carved, and having at the apsidal end a colossal statue of Buddha. There is a series of these covering a period of nearly a thousand years. The earliest—at Bhaja—are the smallest and simplest. At Karli (second century B.C.) the nave has a stilted tunnel vault, and the heavy columns are octagonal, with bases and capitals surmounted by elephants, making the interior somewhat resemble a dark, tunnel-vaulted French Romanesque church. Even more impressive are the largest cave temples at Ajanta and Ellora (q.v.), where temples and monasteries are multiplied side by side in the face of the rock. The massive piers, the wonderfully varied sculptures, and the frescoes at Ajanta are of special interest. The monasteries are more modest: they are often grouped about these temples, and consist of a large central hall, out of which open the individual cells of the recluses, all cut out of the rock. One of those at Ajanta is 65 feet square, and is supported by twenty pillars. The cells are on two sides, the entrance porch at one end and the sanctuary at the other, the whole being richly carved and painted. The third class, the *stupas*, or *topes*, are great brick memorial mounds of circular form. They were at first of domical outline, surmounted by a little chapel or shrine, and surrounded by a marble rail or balustrade entered by four gates. The Bharhut stupa (c.150 B.C.) has been demolished, but that of Sanchi is in splendid preservation. The Amravati stupa is remarkable for its elaborate and beautiful figured sculptures. Finally, the only temple built above ground during the Buddhist period, Buddha Gaya (c.100 B.C.), is in the form of a pyramid with square base, at the corners of which rise four small pyramids. It is 52 meters high, in nine stories, and with three inner superposed sanctuaries. Like all the other early monuments, it is built of brick. Originally it was surrounded by a marble rail like the *stupas*. The pyramidal form is exceptional in the north at this period, though later it became common in the south. Evidently there is little of constructive value in this period, as Buddha Gaya is the only example of the builders' art, the rest being cut out of the mass or mere mounds.

NEO-BRAHMANIC PERIOD. The next period, the Neo-Brahmanic, almost entirely abandons the impressive rock-cut temples and monasteries, and develops decorative details. Indian art, which has hitherto been confined to the North, spreads not only southward, but far beyond the borders of India, and had previously been carried to China. The principal branch of this art is mistakenly called Jaina by some authorities. Its most interesting examples are perhaps in the Province of Orissa. The southern school asserts its independence. In the North the Brahman temples consist of one or more rectangular halls approached by porches and surmounted by curvilinear pyramids, while the temples of the South are immense rectangular inclosures entered through pyramidal doorways of several stories. Even now no true vaults are used in construction, but spaces are covered by false vaults of overhanging courses, and there are no vast interiors as there were in the earlier rock-cut temples. The central halls of the monasteries become open cloisters with their cells. A curious class of buildings at Ellora shows the transition to this period from the Buddhist, for they are in the open instead of cut in the mountain; but are entirely hewn out of the rock instead of being constructed. The Neo-Brahmanic monuments can be classified under five heads: (1) In the Northeast, Orissa; (2) in Bundelkhand and Rajputana; (3) in Gujarat; (4) in the Central Provinces; (5) in the South.

The style in Orissa, as it flourished for 700 or 800 years, differs from that of the South in having no storied towers or columnar halls or *gopurams*. The numerous temples at Bhuvaneswar are its highest expression. The tower of the larger temple (c.600 A.D.) is 180 feet high, and near it is the 'Black Pagoda,' whose superb decoration marks a new era. But in general these temples are small. They are built of stone, which has entirely replaced brickwork in this region. Much later (c.1200 A.D.) is the temple of Jagamath at Puri, which shows the absolute decadence of this style.

Quite distinct is the contemporary school of Rajputana, whose ruined city, Khajuraho, with its several miles of ancient buildings, including some forty temples, is unsurpassed in India. The plan of these temples is more elaborate, being made cruciform by the projection of wings and porches, and the elevation being elaborated by the grouping of many subordinate pyramids and spires around the central pyramid. Each temple stands on a stone platform, and ordinarily measures about 40 meters in height and 35 meters in width. Like the preceding, the remarkable temples at Gwalior date from the tenth to the eleventh century. Decorative and figured sculpture now spreads luxuriantly over every inch of surface. The interiors are small and dark, the supports heavy and broken, and the decoration of the pyramidal exterior has become the most effective part of the style. The style of contemporary towers is shown by the rich examples at Chittur. Perhaps the extreme of delicacy of design and minute care in execution appears in the two temples of Mount Abu (eleventh to twelfth century), built entirely of white marble, and each standing on a raised platform. The carved inside surface of a dome in the earlier of these temples (c.1030) is a more astonishing piece of work than the most elaborate English late-Gothic fan-vaulting. The use of false domes is an interesting feature of a whole group of these temples, including those at Nagda recently discovered.

Passing to the centre of India, we find few but important works. The temples of Ellora (q.v.), famous the world over, exemplify the fusion of Buddhism and Brahmanism. There are about thirty excavated in the rock over a distance of two kilometers, during a period of about three centuries (A.D. 500-800); others, again, as mentioned above, are cut in the rock above ground. The earliest and greatest temple is that of Viswakarma, 26 × 13 × 10 meters, divided into three aisles by 38 pillars. The temple of Indra is remarkably rich decoratively, but less so than the Kailasa (see ELLORA), which is largely in the open (eighth century), cut out of a single mass of rock, and one of the most fantastic and brilliant creations of Indian art. Another group of subterranean temples is on the island of Elephanta (q.v.), dating approximately from the eighth century, and easily visited from Bombay. The absorption of Buddhism by Brahmanism, seen during its earlier stages at Ellora, is almost complete at Elephanta, as shown by the sculptures and ritual. Some of the colossal statues are very impressive.

In the South Buddhism never had a strong hold, and its monuments begin after Jaina and Brahmin supremacy. Here also are, however, some subterranean rock-cut temples, the earliest monuments in the region. There are two groups, at Mahabalipur and at Badami. At the former is a most interesting series of small monolithic temples in the open, similar to the Kailasa at Ellora, and apparently the prototypes of the later pagodas of the South. Both groups are thought to belong to the sixth century A.D., and are among the earliest known Brahmin temples. The finest temple at Badami, though small—as are all these monuments—is beautifully executed in every detail, and unusually symmetrical. The sculpture is very profuse, particularly if we consider their early date; but it is less riotous than in the North. All these buildings are better lighted than the earlier rock-cut temples, which received light only through a big arched opening over the entrance, while here the entire façade is open.

There seems now to be a gap of about four centuries in the art of the South, until we reach the earliest pagodas. Pagoda architecture is characteristic of this region. Its most striking example is at Chidambaram. The plan is a large rectangle about 500 × 400 meters, having a *gopuram* at each cardinal point. These gopurams are rectangular truncated pyramids in several stories; the largest is about 50 meters high and has seven stories. There is a large sacred pond 100 × 60 meters, and the main temple has a thousand columns and measures 103 × 60 × 13 meters. In contrast with the buildings of the North is not only the enormous scale of such monuments, and their elaborate accessories, but also a radical difference in the proportions. The piers are far more slender and higher, with simpler outlines, and the interior effects are better. Even earlier is the pagoda at Tanjore (eleventh century), with a great gopuram tower in fifteen stories directly over the sanctuary; the *mantapam* or temple of the sacred bull, an open colonnaded shrine in three aisles, is a beautiful example of delicate lofty proportions and wide interiors. Another group of extremely sacred pagodas—inaccessible to Europeans—is at Tripetty; still another at Conjeveram.

But the greatest group in the entire South is at **Vijanagara** (q.v.), which has remained a deserted city since 1565. Its monuments are comparatively late, dating mostly from the fifteenth and sixteenth centuries, and they belong to the culminating period of art in this region. The great pagoda of Liva and the temple of Vitoba illustrate the grandiose and monumental character of the buildings, although their taste is less pure than that of previous centuries. Still later is the great pagoda at Madura, an immense and imposing composition (seventeenth century). One of the best portions is the present Bazar or 'Puthu Mantapam,' 100 × 30 meters, with a roof supported by an imposing avenue of 128 piers, mostly in the form of realistic monsters and divinities, in a style much used in the South, but never with such richness and life-like detail as here.

In the matter of size and imposing composition nothing equals the great pagoda of Srirangam, one of the most gigantic edifices in the world. In the construction of the great pagodas it was the custom to make any additions by throwing out another concentric quadrangle, with its series of gopuram pyramids, the original sanctuary remaining in the centre; and, peculiarly enough, every time another quadrangle was erected its gopurams were higher than the preceding, so that the central gopurams ended by seeming insignificant. At Srirangam successive rulers had added to the original pagoda until there were seven concentric rectangles, the outer one measuring 880 × 760 meters. Aside from its size, there is little merit in the structure, as it is bare or poor in detail and design. As a whole these Southern pagodas are the most impressive buildings in India.

There is a region in the South, Mysore, which remains an architectural mystery. Hardly touched by explorers, it promises a rich and original harvest, if we can judge from the temples of the deserted cities of Baillur and Hullabid, wonderful and delicate creations, showing a sense of proportion and restraint unusual in India.

BUDDHIST STYLE IN NEIGHBORING LANDS. Passing now to outlying parts of India and neighboring provinces, we find in the sequestered province of Nepal, between India and Tibet, an archaic style that explains some of the origins of Indian art and illustrates the connection with China. A first type of monument is that of the large circular domical stupas of earth and brick, surrounded not by a balustrade, but a simple plinth, and dedicated to Buddha. These are the earliest (Sambunath, Buddnath). A second and far commoner type is that of the pagoda-like temples in brick and wood formed of several stories of superposed roofs, each one in retreat and raised at the corners, in perfect analogy to Chinese monuments (Bhatgaon, Patan). A third type is that of stone temples of quite a different style and of admirable design. Chronologically all these buildings are late—not more than two to five centuries old—but they represent earlier types in a region that remained in a prehistoric undeveloped condition. So the class of pagoda-like temples of brick and stone is of extreme interest. It is the same in Burma, where many monasteries were built of wood or brick, and forms of Babylonian origin are perpetuated.

Of even greater architectural interest is Cambodia, whose ruined cities have only recently been discovered, with buildings dating between 950 and 1350. Here brick construction and stonework are very successfully combined. The ancient capital, Angkor, has a superb series of temples, particularly that of Nakhon Wat. Its inclosure measures about one mile each way, and the buildings are well composed. As in Southern India, there is a large pond surrounded by courts, corridors, and temples. Grouped pyramids are used, in stories of decreasing size. Monumental staircases most effectively connect the buildings. The sculpture is exceedingly rich, but is symmetrically arranged, and the lines are not broken up, but compose simply in a manner quite un-Indian.

The Renaissance character of some of the ornamentation is startling. In quality of detail the Angkor buildings are unsurpassed in India.

In Java, also, there is an interesting offshoot of Buddhist art. Its chef-d'œuvre is the famous Boro-Buddor (q.v.), built in the seventh century, a perfect epitome of Buddhist art before its fall. It is a stupa or dagoba in seven stories, approached by five processional paths, along which are seventy-two small domes surmounting separate dagobas which surround the central one. Nothing like this remains in Northern India among Buddhist monuments, so that for comparison one must go to Gandara, in the Northwest, to Jamalgiri and Takht-i-Bahi, which are its prototypes.

Still another little-explored region is the island of Ceylon, which also contains a mass of Buddhist monuments. The ancient capital, Anuradhapura, is unique among Buddhist cities in having a series of monuments illustrating this cult throughout nearly a millennium, it having lasted here for centuries after Brahmanism had displaced it on the mainland. There remain seven separate stupas, with processional paths, as in Java. Two of these stupas have three rows of high columns surrounding the central mound, monoliths about 26 feet high, reminding of the columns of a Persian palace. There is but little sculpture used in the decoration, and in some of it the lines of hieratic animals give additional points of resemblance to Western Asia.

MOHAMMEDAN STYLE. The superb Mohammedan architecture of India is treated under MOHAMMEDAN ART. It belongs to two stages—the Afghan and the Mongol. In some cases, as at Ahmedabad, the fusion with pure Indian art is so thorough as to leave only part of the credit to imported ideas from Persia and Bagdad. But at Delhi and Bijapur the style is fundamentally foreign.

DECORATIVE ARTS.

GENERAL CHARACTER. The religious character of Indian art is quite as prominent in other branches as it is in architecture. A knowledge of the intricacies of the Hindu pantheon is a necessary prerequisite to the study of the sculpture and painting, the pottery and even the lacquers, bronzes, and goldsmith work. There is little æsthetic value to the representations of the human figure in India; they interest in the mass, as decoration; and for their subject, as illustrative material for the study of Indian thought. The endless repetition of the same theme in the same monument is characteristic of its symbolic use, as it is, indeed, of the Oriental spirit. This impersonal character has favored the extraordinary tenacity of tradition and continuity of style still to be observed in the various provinces. This has been made possible by the hereditary nature and continuous life and organization of the different crafts, not only in the guilds of the cities, but especially in the groups of artisans which, organized as guilds, have for some 3000 years formed an integral part of the village communities of India, supplying its inhabitants by perpetual contract. The sumptuary arts fostered by the aristocracy naturally flourished in the cities and not in these village communities. Although originality vanished centuries ago, no fundamental damage had been inflicted on Indian arts until under British rule the incongruous architecture of Europe, the degrading methods of machine manufactures came into fashion in place of the native methods of hand work. This tenacity makes it possible to study some of the methods of antique art in modern India, because the continuous overland trade during antiquity and the Middle Ages kept India in constant relations with Persia, Babylonia, and Assyria, Egypt, and the late Hellenic States after Alexander's time, and later with the Mohammedan powers. The stepped temples of Baylonia, the filigree gold jewelry of Etruria and Greece, the enameled tiles of Persia, the products of the looms of Mesopotamia, and, later, the arts of the Mohammedans of Egypt, Syria, and Persia, were all echoed in India, with greater or less purity. Yet there was always enough of a transformation to give an aspect of Hindu unity to whatever was borrowed. Indian art has always been full of a character of its own. Its greatest successes have been in its decorative work, both on a small scale and in masses, and in the imposing compositions of its architecture. Its failures are due to a poor sense of form both in line and composition.

SCULPTURE. The three centuries before and after the Christian Era saw the development, under Buddhist influence, of the most artistic schools of sculpture that India ever saw. In certain parts of the North and Northwest, especially, there are strong traces of Greek and Persian influences, as in several monuments of the region of Peshawar. The famous Asoka edict-pillars and the encircling marble rails of the Buddhist *topes* of Bharhut, Buddha Gaya, and Sanchi (Bhilsa), all belong to the earliest stage (c.250-200 B.C.). Somewhat later are the rich series of the Amravati type and the sculptures of the earliest cave temples of Ellora, Kanheri, and Ajanta. The Buddhist style was continued in Ceylon after it had decayed on the mainland, as is shown at Anuradhapura. Most of these sculptures can be studied in the South Kensington Museum (London) or the Indian Museum (Calcutta), and in the British Museum and the Madras Museum. The subordination of sculpture to architecture is evident even at this early period: the human figure, though used in colossal size in statues and high reliefs, especially in representations of Buddha, is usually in rather minute proportions, and in confused and intricate compositions. Line upon line of reliefs are superposed, in which architectural detail and decorative design play an important part. The rock-cut figures of the caves are hardly as delicate as the earlier sculptures of the rails or the later work on the open-air temples. The almost classic style of Muttra, of which echoes even survive at Amravati, is gradually replaced by one given to grotesque and exaggerated forms: the female figure especially is treated with undue emphasis. No ideal types were created. The prevalent realism expressed itself more successfully in animal forms, which were plentifully interwoven with human and decorative motifs.

After the decay of Buddhist art, sculpture did not revive till the Jaina period of the eleventh century, whose temples at Gwalior, Mount Abu, and Khajuraho show the existence of a style of exquisite delicacy and profuse richness. Every part of the surface of the temples at Mount Abu, both within and without, is carved, and the later style of Hindu sculptures finds here its prototype. Horizontal lines are emphasized: decorative design is given more importance than purely figured compositions. Then and even earlier the art of sculpture received great development in outlying regions, in Kashmir, Tibet, and the French sphere of influence. There probably never existed a style of art in which sculptured ornament was so profuse as in the art of India and its neighbors. A second decadence came with the Mohammedan conquest: decorative design still flourished, but the Moslem dislike for the portrayal of the figure had its effect. Hindu traditions, however, were stronger than the Mohammedan belief: the recent sculpture of Delhi, Bombay, and Madras is directly derived from the eleventh century style through intermediary stages. Martand and Avantipore in Kashmir, Madura, Ellora, Puri, and Khajuraho contain the foremost works of the old Hindu school. Cole's *Catalogue to the Objects of Indian Art in the South Kensington Museum* (London, 1874) gives a good classification of the sculptures, which are also described in Fergusson's works, and in special monographs and volumes of the Government surveys and reports. The three divisions of the Brahman style—Dravidian, Chalukyan, and Indo-Aryan—all afforded great scope for sculpture by the elaborate plans and colossal proportions of their sacred buildings. The most extensive and magnificent sculptured effects in the Dravidian style are found at the temple of Rameswaram, in the Chalukyan style (with great prevalence of animal and bird friezes) at that of Hullabid, in the Indo-Aryan (Hindu) at Bhuvaneshwar.

The lack of æsthetic qualities in composition and form, which prevented monumental sculpture from reaching a high level of achievement, was not noticeable in the smaller branches of sculpture, such as carving in wood, marble, soapstone, and ivory, metal-work, clay figurines, as well as inlaying and enameling. The naturalism and exquisite detail here appear to advantage. Work in black wood, ebony and sandalwood is still carried on in many villages, for small objects, and in teakwood for the details of house decoration. Carved ivory is as popular as in China and Japan, both for statuettes and for reliefs of religious and genre scenes, hunts, animals, and birds.

Painting. There is not the same continuity in the use of painting as in the other larger arts. The developed Buddhist art of the period after Christ appears to have used wall-painting on a monumental scale, as in the caves of Ajanta and Bagh in Malwa, but then, as well as later, the impulse came from abroad, usually from Persia. At later times painting was spasmodically employed and became popular in the decoration of sculpture. The identification of the numerous gods by means of their symbols or emblems, and the emblematic use of different colors in their dress, made color an essential element in statuary and relief work. The Mohammedans introduced the illumination of manuscripts from Persia, and later still miniature painting became popular, especially at Delhi. The *Shah Jehan Nameh* and others in the Royal Library at Windsor, and the *Life of Timur*, belonging to Earl Amherst, are beautiful examples of illuminations.

Jewelry. Of all the smaller arts in India, jewelry is the most universally interesting and beautiful. In it we see survivals of early and late Etruscan, Greek, and Asiatic forms, undoubtedly descended from imported originals. The techniques of filigree and granular work, only recently rediscovered in Europe after antique models, never were lost in India. There are at least three very primitive types of jewelry: (1) The heavy gold wire twisted into collars, girdles, bracelets, anklets, and necklaces, used originally throughout India; (2) the chopped gold style made of flat or cubic pieces, strung together, and either solid or hollow, all of general use, but now most popular in Gujarat; (3) the flat beaten silver type of many primitive tribes, similar to early Celtic work. There evidently is great similarity between the Indian races and the Etruscans in the profusion of jewelry that was always worn, as is evident from the earliest literature, such as the *Rig-Veda;* and the sculptures show that its forms have remained unaltered for over two thousand years. The present schools are those of Ahmedabad, with its archaic style; of Mysore, Vizianagram, and other towns, in thinnest pieces of beaten gold; of Kashmir and the Punjab, for the use of gems and enamels in richest but always tasteful variety; of Sindh and Beluchistan, similar but more solid and severe; of Oudh, formerly centred in Lucknow, similar to that of Delhi and Lahore; of Cuttack in Orissa, famous for silver filigree work; and a multitude of minor centres, like Dacca and Dinajpur in Bengal, the work of the last-mentioned place being extremely primitive. The Parsis of Bombay long held on to antique Persian forms, and the South used mythological subjects. The school of Trichinopoly, with very rich chains, necklaces, and bracelets, has long been a favorite one with Europeans. In fine, India has sounded every extreme and form of jewelry, from the most simple and primitive to the richest. See Jewelry.

Pottery. Even more than jewelry the pottery of India, especially in its unglazed varieties, preserves the ancient forms shown in the early sculptures and paintings. The potters of the villages have never changed these forms since very early times. Unglazed pottery has been made everywhere in India, and still survives quite generally, especially in the Punjab. Decorative pottery for commercial purposes, painted, gilt, glazed, or even pierced, is made in special varieties in different provinces: for instance, the gilt pottery at Amroha, the black and silvery ware at Azimghar, whose meretricious art is in great contrast to the simply beautiful glazed ware of Sindh, of Madura, and of the Punjab. The special preeminence of the best Indian pottery has always been the strict subordination of color and ornament to form and the conventionalizing and repetition of natural forms in the decoration. The glazed ware of these three schools only is worthy of standing beside the beautiful primitive unglazed pottery. Their knop and flower patterns, and other favorite floral designs, imitate classic and even Assyrian, Persian, and Egyptian originals; the shapes of the vases are also those of antique examples found in Oriental, Etruscan, and Greek tombs. The turquoise blue, golden brown, dark green, or purple colors are the most beautiful. The exquisite color tones and combinations can be studied even better in the glazed tiles which came into fashion with the Mohammedan conquest after the eleventh century. These encaustic tiles, when used to cover large wall spaces, or even entire buildings such as mosques, produce an unparalleled effect of splendor. Here especially is Persian influence predominant. The potter was also the image-maker, producing innumerable painted clay figurines, mainly of the gods, to be worshiped in families and shrines.

Metal-Work. Among the branches of artistic metal-work that of the arms and equipment of the great chieftains is prominent. The Buddhist, Hindu, and Jaina sculptures show how antique are many of the forms still in recent use, but of actual works that are preserved the finest do not date back of the great Mahratta warriors. There are two main schools, the Hindu and the Persian. The Punjab and Rajputana were among the main centres of the art. A comparison of the three great schools of the mediæval Orient shows that the most delicate and simple was the Arab, with its fine filigree work; richer and more highly colored was the Persian with its damaskeening, enameling, and carving; but richest of all was the Indian, which indeed sinned, perhaps, by excess of decoration, breaking the outlines and color scheme by high relief, hammered and cut goldwork, and a multitude of gems. The collection of King Edward has the finest examples of damaskeened suits, of crusading blades carved in relief, and of early matchlocks. The use of carved ivory often gives added brilliancy. Diamonds, rubies, and emeralds are the principal stones used, and the designs are largely floral. The collection of the India Museum ranks next to that of King Edward. Of the chieftains' swords valued as heirlooms and State possessions the finest are those of Swaji, Sultan Chand, and Polygar Katabomma Naik.

Damaskeening in gold and silver wire is a process probably imported during the Middle Ages into India from Persia and Syria. It is practiced in Kashmir, the Punjab, and the Nizam's dominions, though originally of wider use. The ornamentation is in floral patterns, either naturalistic (Bider) or conventional (Purniah). The boxes, bowls, vases, and caskets with this decoration often equal the best Mohammedan work of Egypt and Persia, and are among the most harmonious of Indian industrial works for form and well-composed ornament. The relief work in metal is less chaste and admirable, whether in brass, copper-gilt, bronze, or the precious metals, where the high relief technique and human and animal figures are often used. The gold and gilt work, however, is usually exquisite. The oldest examples are Buddhist pieces found in the Punjab and Afghanistan with Greco-Roman characteristics. The later work in chased parcel-gilt and gold sometimes pierced, especially that of Kashmir, is beautiful in shape, the gold being often given a ruddy hue or olive-brown. Lucknow, Dacca, Cutch, and Gujarat have been famous goldsmith centres.

Images or idols of gold and silver, brass and copper, or of an elaborate alloy, have always been profusely used in private houses for worship. Some are of gold, as those of Krishna and Saraswat; others of silver, as those of Shitala; others of copper, such as those of Surya and the serpent Naga. The larger figures are always cast and finished by hand.

Enamel. The art of enameling in *champlevé* is still practiced in greatest perfection at Jaipur in Rajputana, unique for the beauty of its ruby reds, coral reds, emerald greens, and turquoise and sapphire blues. Somewhat less perfect are the products of the schools of Lucknow, Benares, and Lahore. Indian enamels are combined remarkably with precious stones. Transparent enamels are used with success, and sometimes a thin plate of gold cut in elaborate scenes of figures and ornamentation and etched with a graver is superposed over an enamel ground melted on a gold back.

Woven Fabrics. The brocades, embroideries, woven tissues, laces, tapestries, and the like, so long one of the greatest prides of India, have suffered more than any other branch of art industry. The most sumptuous brocades come from Ahmedabad, Benares, and Murshidabad. The gold embroidered velvets for state canopies, housings, and caparisons are especially rich. But their designs are not as purely Oriental as are those of the appliqué-work on cloth and the early rugs and carpets with their Persian compositions of birds and animals. The jail industry and the so-called schools of industry have done even more than the rush orders from Europe to degrade the quality—both material and artistic—of India carpets.

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INDIANA UNIVERSITY. A coeducational institution of learning, situated at Bloomington, Ind. It was founded in 1820 as Indiana Seminary, and was rechartered as a university in 1838. The university is an integral part of the State public school system, and admits pupils from commissioned high schools without examination. It maintains a professional school of law, and confers the degrees of bachelor of arts, bachelor of laws, master of arts, and doctor of philosophy. No honorary degrees are conferred. The university has a biological station on Winona Lake. The summer school, formerly privately conducted, is now a part of the university. The elective system was introduced in 1885. In 1902 the faculty numbered 70, and the attendance was 1334, including 104 in the law school. At the same time the university had grounds and buildings valued at $400,000, an endowment fund of $600,000, and an annual income of $165,000. The library contains 43,000 volumes.

INDIAN BADGER, BUFFALO, etc. See Badger; Buffalo; etc.

INDIAN BIBLE. An Algonquin version of the Bible made by John Eliot (1661-63). This translation was the earliest version of the Bible to appear in America.

INDIAN CORN. See Maize.

INDIAN CRESS. See Tropæolum.

INDIAN EMPEROR, THE, OR, THE CONQUEST OF MEXICO BY THE SPANIARDS. A tragedy by Dryden, successfully produced in 1665. It forms a sequel to the *Indian Queen.*

INDIAN FIG. See PRICKLY PEAR.

INDIAN FIRE. A bright white signal fire, consisting of a mixture of potassium nitrate 24 parts, sulphur 7 parts, and arsenic disulphide 2 parts.

INDIAN HEAD. The highest point of the Palisades of the Hudson, opposite Hastings, so called from its resemblance to the features of a human being.

INDIAN HEMP. A very strong bast fibre obtained from the perennial herb *Apocynum cannabinum,* and used by the American Indians for weaving and for cards and nets. It is also sometimes called Canada hemp.

INDIAN LANGUAGES. The languages of India are both numerous and important. Cust in his book on the *Modern Languages of the East Indies* (London, 1878) enumerates nearly two hundred and fifty Indian languages, and some three hundred dialects. Of these languages divisions are: First, the group of Aryan tongues spoken throughout the entire northern half and central portion of India; second, the unrelated Dravidian group (q.v.) in the south; third, the Kolarian languages scattered here and there in Central Hindustan; fourth, the Tibeto-Burmese family of non-Aryan tongues, distributed over the vast area which the name implies; fifth, the Khari, an isolated language near Bhutan. To these may be added likewise two Indo-Chinese spoken families, namely, the Thaï, under which comes the Siamese, and the Mon-Annam family, which takes in the Cambodian and Annamite. It may furthermore be stated, for completeness, that the languages of the great Malayan family spoken in Sumatra, Java, Borneo, and the Celebes, and even in the Philippines, have certain Indian affinities or show the influence of the various tongues of India.

The Aryan group of languages in India has preëminence alike for the number and the character of the people that speak those dialects, and for the genius of the languages themselves, as well as for the long historical development of this branch, and for the literature attached to it. In point of time the Aryan division of Indian tongues covers a period of culture extending from at least a thousand years before the Christian Era down to the present time. Broadly viewed, these periods may be recognized in the history of this division of dialects: (1) *Old Indian,* comprising the earliest Vedic dialect and the historic form of the speech known as Sanskrit (q.v.); (2) *Middle Indian,* which embraces Prakrit (q.v.) and Pali (q.v.), both of which are descended rather from the Vedic dialect, or its kin, than from the classical Sanskrit; (3) *New Indian,* including the modern vernaculars of the more cultivated peoples of Hindustan. The general characteristics of the Vedic idiom, together with certain peculiarities of the epic speech, and the classical development of the language, will be found in the article on SANSKRIT LANGUAGE. Under the Middle Indian or Prakrit group are comprised the Maharashtri dialect, or Prakrit par excellence, with its Jaina varieties, likewise the Magadhi or Ardha-Magadhi, the Sauraseni, which is found in the dramas, the *Apabhraṅśa* and the *Pāiśacī.* The New India group, geographically arranged, takes in the vernaculars of Assam, Nepal, and Kashmir (the latter called Kasmiri), also Uriya, Bengali, Behari, Hindi, the dialects of the Punjab and of Sindh, likewise Gujarati, Marathi, the Singhalese of Ceylon, Maldive, and Gypsy.

BIBLIOGRAPHY. The standard work on the Aryan languages of India is Grierson, *Linguistic Survey of India* (Calcutta, 1898). Consult also: Beames, *Comparative Grammar of the Modern Languages of India* (3 vols., London, 1872-79); Cust, *Modern Languages of the East Indies* (London, 1878); and for the phonology, Gray, *Indo-Iranian Phonology, with special reference to the Middle and New Indo-Iranian Languages* (New York, 1902).

INDIAN MADDER. See CHAY ROOT.

INDIAN-MEAL MOTH. One of the most familiar moths (*Plodia interpunctella*) that infest the cereals, Indian meal, dried yeast-cakes, and dried fruits, nuts, etc. The moth has wings which are reddish brown on the outer two-thirds and dirty whitish gray on the inner third. It has a wing expanse of rather more than half an inch. The larva is white, brownish-headed, and worm-like. It spins silken tubes through the substance on which it is feeding, and its excrement and portions of the food adhere to this web.

INDIAN MILLET. A term applied to certain non-saccharine sorghums. See MILLET.

INDIAN MUSIC. The music of the aborigines of North America, although never reduced by them to a written science, is nevertheless marked by distinct racial characteristics. Of the greatest importance to the Indian musician was the emotion to be expressed; to this everything was subordinated. As a result the Indian songs can be divided into certain stereotyped classes (such as burial, love, war-songs), in each of which the similarity of the different melodies is most marked. This monotonous character of their tunes is an outgrowth of the very elements which among civilized peoples have been skillfully blended to produce original and unusual effects; for preëminent in Indian music are complicated rhythms (many of them as intricate as those of Schumann and Chopin) and a frequent use of syncopation. When it is remembered that they had no strict forms to restrain them, it will be seen how these two strong elements came in time to dominate and confine their whole musical system. The strictly technical side of Indian music is of less interest. Their scale, like the Chinese, Hindu, etc., consisted of five tones, and was, for the most part, major; their melodies generally ran from the top of the scale to the bottom; their conception of time was very exact; but they had no part-singing; no way of determining pitch, and consequently no universal key. Of most interest to the cultured musician are the wonderful transitions which we find everywhere throughout the native songs. The smoothness and rapidity of their changes from key to key are unsurpassed even in European music. The Indians had a sense of harmony, but, owing to the crudity of their musical science, it was never developed. Only by the use of wooden drums, toned to different pitches, did they get a sort of crude bass. Besides the drums their instruments consisted merely of a flute (with a scale of seven notes), a whistle (with a scale of five notes), and a rattle, made of dry gourds, loaded with sand or pebbles.

INDIAN MUTINY, or Sepoy Rebellion. See under India.

INDIAN MYTHOLOGY. The mythology of India as found in the ancient hymns of the *Veda* deserves especial consideration, because it represents an earlier state of thought with regard to mythological subjects than is found in any other literary monument of the Indo-Germanic peoples. The development of Hindu mythology down to the present is furthermore of interest because of the chance it gives for a long historical perspective. Attractive parallels may likewise be drawn between the oldest mythological figures of India and those in the pantheon of Greece and Rome, like Father Heaven and Mother Earth (Skt. *Dyāuṣ Piter, Pṛthivī Mātar*, Gk. Σεὺς πατήρ, Lat. *Jupiter*), but they are often erroneous, dangerous, or misleading. Despite, for example, the recognized possibility of kinship by reason of common Aryan or Indo-Germanic unity, such etymological equations as those between Lat. *Uranus*, Gk. Οὐρανός, 'Heaven,' and Sanskrit *Varuṇa*, in Indian mythology, or again between Κένταυρος and *Gandharva*, or the fire-myth of *Prometheus* in connection with Skt. *pramanthana*, the rubbing stick used in kindling fire, break down or become uncertain under the searching light of keen linguistic criticism. Nevertheless, such comparisons are always interesting, and they are often instructive as showing how myths may develop independently or on grounds remotely associated or even disconnected. The mythology of India frequently helps to throw much light on such subjects. Myths abound in the *Rig-Veda;* they are the outgrowth of personifications of the powers of nature and meteorological phenomena. (See Agni; Indra; Marut; Mitra; Soma; Sūrya; Ushas; Vāyu; Yama.) In later Hindu mythology the gods of the old régime gradually become replaced by the great Hindu trinity or triad, Brahma, Vishnu, and Siva, with all the beliefs and notions associated with each of these names. The later pantheon is occupied likewise by a band of minor deities, godlings or demigods, like Ganeśa, Kartikeya, Kubera, and the goddesses Durga, Lakshmi, and Sarasvati. (See the articles under these names.) India of all ages has known also many myths, legends, or fables connected with the stars and planets, with sacred rivers, streams, and trees, birds, and animals. Consult: Wilkins, *Hindu Mythology* (London, 1900); Dawson, *Dictionary of Hindu Mythology and Religion* (London, 1879); Macdonell, "Vedic Mythology," in Bühler, *Grundriss der indo-arischen Philologie und Altertumskunde* (Strassburg, 1897).

INDIAN OCEAN. One of the five grand divisions of the hydrosphere, bounded on the west by Africa and the 20th meridian east of Greenwich (running through Cape Agulhas, the southern extremity of Africa), on the north by Asia, on the east by the East Indian Archipelago, Australia, and the 147th meridian (running through the southern extremity of Tasmania) (Map: World, Eastern Hemisphere, K 28). The southern boundary is in an indefinite way assumed to be approximately the Antarctic Circle, although many geographers prefer to call what is south of latitude 40° S. the Southern Ocean. In its broader sense it covers about 27,500,000 square miles. Gradually narrowing from south to north, the Indian Ocean forks at Cape Comorin into the Bay of Bengal on the east, and the Arabian Sea on the west, the latter again branching off into two arms, the Persian Gulf and the Red Sea, which reach respectively the mouth of the Euphrates-Tigris and the neighborhood of the Mediterranean. These limitations exclude the waters of the Indian Archipelago, as belonging rather to the Pacific Ocean. From Africa it receives the waters of the Limpopo and the Zambezi, and from Asia those of the Irrawaddy, Brahmaputra, Ganges, Indus, and the Shat-el-Arab. It contains numerous islands, chiefly confined to the northern and western regions. Of these Madagascar and Ceylon are the only ones of considerable magnitude, the others being mostly small groups of volcanic or coral formation, the volcanic islands being usually surrounded by coral reefs.

The greatest depth of the Indian Ocean is found in the northeastern part, where, close to the southeast of Java, soundings have been made of 20,340 feet, and a considerable basin of nearly this average depth lies to the northwest of the Australian continent. An elevated ridge running along the 40th parallel has an average depth of 12,000 feet. Krümmel estimates the average depth of the ocean to be 10,970 feet. The surface temperature of this ocean is higher than that of the others, the mean temperature of the northern portion being considerably over 80°, while the bottom temperature, falling below 40° at the equator, indicates an undercurrent of cold water from the Antarctic region. The currents of the Indian Ocean depend to a great extent on the winds. North of the equator they reverse their direction with the annual change of the northeast trade wind to the southwest monsoon, while under the equatorial calm belt the equatorial countercurrent flows eastward. South of the equator, under the southeast trade winds a current flows west, bending south along the coast of Africa through the Mozambique Channel, and meeting the Atlantic westward current at the Cape, where it is turned back to the east toward the south coast of Australia. The winds over the Indian Ocean are, as a rule, gentle, with frequent protracted calms, though hurricanes occur occasionally. This ocean was the first to find a place in the history of commerce. As a commercial channel it virtually maintained its superiority during two thousand years, being habitually traversed in a direct line between Arabia and Hindustan, while coasting voyages alone were known in the Atlantic. This comparatively bold navigation of the Indian Ocean was suggested and facilitated by the periodically alternating monsoons of the northern part.

INDIAN OIL TREE. See Butter-Tree.

IN'DIANO'LA. A city and the county-seat of Warren County, Iowa, 18 miles south of Des Moines, on the Chicago, Rock Island and Pacific, and the Chicago, Burlington and Quincy railroads (Map: Iowa, D 3). It controls a large trade in grain, butter, eggs, live stock, fruit, and vegetables. The city has a public library and Simpson College (Methodist Episcopal), opened in 1867. The electric-light plant is owned by the municipality. Population, in 1890, 2254; in 1900, 3261.

INDIAN PEOPLES. For the anthropologist India is of remarkable interest. On its soil may still be met all grades of culture, from the savagery of hill and swamp to the urban civilization born of river and plain, and all forms of human social aggregates, from the primitive family group or clan to the foreign-ruled provinces with their magnificent and luxurious capitals. Here all forms of agriculture are to be found, from the burned-over forest plot to the terraced hillside of the north; in the west and south the utilization of the desert by canals and tanks; all varieties of human dwellings, from the primitive abode in tree and cave to magnificent palaces and temples; all forms of human government, from the primitive democracy and tribal anarchy to organized despotism of the civilized sort; all kinds of marriage, from polygamy to the strictest monogamy, and all varieties of both these systems, and of polyandry as well; as well as all forms of religion from the crudest animism and Shamanism to the agnosticism of certain developments of Buddhism. All these things have been invented, exploited, modified, improved, or degraded by members of the black, the brown, the yellow, and the white races of man for many thousands of years; so that nowhere else in the world have so many millions of human beings done so many things at so many times in so many ways as in India. Remains of the industry of Paleolithic man have been found almost everywhere throughout the peninsula, which makes India seem almost as old as the race of man itself. By far the most important peoples of India belong to the Aryan stock. They are responsible for a number of social and religious ideas and institutions, many of which are simply the expression of the mentality of the more northern and western Aryan in the process of, and after adaptation to, an Oriental and largely tropical environment. They never overcame the land by mere force of numbers, and their influence upon the pre-Hindu population was less racial than social and religious. Many primitive tribes who took over the culture of their conquerors have become assimilated to the Aryan type while preserving intact their aboriginal speech. The complicated caste system (see CASTE) is largely, if not entirely, the result of the contact of the Aryan invaders with the aboriginal population (Dravidian, Kolarian, etc.) of the peninsula, and of the efforts of the conquering race to preserve its purity as much as possible against miscegenation. It was very early dominated by religious ideas, but recent investigations have shown that the lines of caste are not nearly so coincident with racial distinctions as had been assumed to be the case. After the Aryans of India, the Dravidians (the civilized Tamils, Telugus, Kanarese, and Malayalams), the more or less civilized Kodagu, or Koorgs, and the tribes of the Nilgiris, Central India, Orissa, part of Bengal, etc., such as the Irulas, Kurumbas, Badagas, Todas, Kotas, Kader, Khonds, Gonds, Oraons, and Maler, are the most important peoples. The various tribes of this stock illustrate all grades of human culture, from the jungle-dwelling Kurumbas to the high developments of the civilized Tamils, who in literature, architecture, and other arts have shown great ability, and some of them notable capacity for assimilating both Hindu and Christian culture. The Dravidian area lies chiefly in Southern India, but the Tamils have extended their influence over the north of Ceylon, forming a very important part of the population of that island.

Next to the Dravidians are to be considered the Kolarian peoples (Munda-Kols, Larka-Kols, Bhumij, Santals, Kharia, Juang, Saoras, etc.) of the Orissa-Bengal country and farther inland. The Santals represent the highest development of Kolarian culture, and the Juangs perhaps the lowest; while the others, except some of the Kols, are more or less primitive. Like the Dravidians, the Kolarians, who are looked upon by some as a people even older, have given to and taken from the ancient and modern Hindus, and have also undoubtedly affected the physical type of both Dravidians and Aryans. In the Kolarians, as in the Dravidians, certain scholars detect traces of negroid intermixture, as well as much Aryan and some Mongolian blood. The Veddas of Ceylon, by some ethnologists classified as a separate variety of mankind, certainly are one of the most primitive peoples now existing. They have been thought to represent the oldest non-negroid population of India, now disappearing. Some have sought to class the Todas of Southern Hindustan as a peculiar people. The islands off the Indian coast present some interesting tribes. The Selungs of the Mergui Archipelago are classed by Deniker as 'Indosenians'; but this is rather doubtful, and a like uncertainty exists regarding the inhabitants of the Nicobar Islands, the natives of the interior of Great Nicobar being savages of a rather primitive type. The Minkopis or Andaman Islanders are characteristic Negritos, whose extension must at one time have been much greater. In Assam, Burma, and the Malaccan possessions and protectorates of Great Britain, a great variety of peoples are to be found, chiefly of Indo-Chinese, Proto-Malay, and so-called 'Indonesian' origin, besides the Sakai and Semang of Malacca, who are more or less Negritos. Among the most notable of these peoples, outside of the Burmese, Karens, etc., are the Nagas of Manipur, the Chins of Burma and Arakan, the Lushai tribes of Assam, the Shans of Northern Burma, and some other tribes.

The anthropological history of India includes the following successions and impacts of races: Pre-Dravidian and pre-Kolarian (with mixtures of Negrito and Proto-Malay); Aryan (invasion by the northwest as early as B.C. 2000 at least); Greek invasion, in the time of Alexander the Great (locally important in the Indus region, and more important as partly opening India to the Western world); Bactrian invasions of the northwest (following the Greek, and of local importance); Mohammedan invasions (A.D. 1000-1400), resulting in the establishment of many dynasties in the northwest and west, including the famous Mogul Empire of Delhi, and its successors of the eighteenth century, which were broken up by the revolt of the Mahrattas and Sikhs, who restored Aryan supremacy. Besides these must be counted the Pathan influence in the northwest at various times, the Mongol (Tibeto-Sinitic) influence from a comparatively early period in the Himalayan region, and Indo-Chinese and related influences in the northeast. Malayan elements also were present in the south and east, with the later Arabo-Persian, Dutch, Portuguese, French, and British commercial, missionary, and political achievements. The Parsis (Persians), who are settled chiefly in Bombay, are of great importance in spite of their limited numbers; the Jews have had some influence on the east coast; and the Chinese in Ceylon. Since coolie labor has been in demand natives of India have found their way to Madagascar, the West Indies, Guiana, and Africa.

INDIAN PHYSIC. A genus of North American herbs. See GILLENIA.

INDIAN PIPE. See ROOT PARASITES.

INDIAN POKE. See HELLEBORE.

INDIAN QUEEN, THE. A tragedy by Sir Robert Howard, in collaboration with Dryden, produced with great splendor in 1664. Its success was probably due to its scenic effects rather than to the heroic verse in which it was written.

INDIAN RED. An impure ferric oxide of a dark-red color, with a tinge of purple. It is used as a pigment. Much of the Indian red of commerce is prepared artificially by the calcination of a mixture of copperas and lime.

INDIAN RESERVATIONS. See INDIAN AFFAIRS; TREATIES, INDIAN.

INDIAN RIVER. A tidal inlet along the east coast of Florida, in Brevard and Volusia counties, running inside a sandy bar or beach a half to one mile in width (Map: Florida, H 4). It connects with the similar Halifax River at Titusville, and extends 100 miles south-southeast, opening into the ocean at Indian Inlet. Its width varies from a few hundred feet to three miles, and it is navigable for vessels drawing five feet.

INDIANS, AMERICAN. The name applied first by Columbus and his immediate successors to the natives of the newly discovered islands and mainland of America, under the mistaken impression that these regions were a part of the outlying coast of Asia. The name most frequently used by scientific writers, especially in Europe, is simply *American*, while the term *Amerind* has recently been suggested as a substitute. Recent authorities class the Eskimo with the yellow rather than with the red races; the reader will find them treated under ESKIMO.

Granting the existence of a group of characteristic races which may be termed American, the problem of their origin remains unsolved. It is almost certain that no common origin for all of them can be assumed, but that various sources of population and centres of dispersion must be considered. Failing accurate knowledge of the geological conditions existing in earlier epochs, the most probable sources of immigration were Asia by way of the northwest coast of North America, Europe by way of Greenland, and the general region of Polynesia by way of South America. There are correspondences in physical types and cultures which tend to support particularly the idea of Asiatic and Polynesian relations. However, the theory of the Americas as an independent centre of origin has much in its favor, and must be taken into account. For example, the Eskimo, who form a strikingly homogeneous group wherever found, would appear from the evidence to have occupied, in former times, the territory in the neighborhood of Hudson Bay, and to have spread from that focus north and east and west, following the Arctic coast-line, and it is unquestioned that the Asiatic group of Eskimo is of American origin. In short, the problem is complex and deals with a very remote period, which prevents satisfactory treatment. The most popular explanation is, of course, that of Asiatic origin, based upon the striking similarities in type and culture which are evident to even superficial observation. It must be remembered, however, that any relation is mutual, and it is quite as easy to argue for an Asiatic origin from America as for an American from Asia.

A striking characteristic of the race is the marked uniformity of physical type throughout the two continents of North and South America. In general the color is brown, frequently with reddish tint, light in some tribes and dark in others. The hair is glossy black, either straight or slightly wavy, and baldness is almost unknown. The beard is usually scanty, and is seldom allowed to grow, although a light mustache is somewhat common. The cheek-bones are prominent; the nose usually good, and in some tribes strongly aquiline; the eyes dark and apparently small, from being held less open than in the white man. In cubical brain capacity and structural development the Indian holds a middle place between the white man and the negro. In mental capacity, physical strength and endurance, as well as in vital force to resist or overcome disease, he is far below the white man.

INDIANS OF THE UNITED STATES AND BRITISH AMERICA.

DRESS. As became tribes largely made up of hunters, the dress was generally of skins, so fashioned as to combine the greatest protective warmth with the least incumbrance of weight. From the Arctic Circle to the Rio Grande or farther, except in California and the adjacent region, the native dress was usually of buckskin, consisting, for the men, of a shirt, G-string, or breechcloth, leggings, and moccasins, and for the women, of a short-sleeved tunic, waist-cloth or apron, belt for knife and sewing-awl, with leggings and moccasins, generally made in one piece. The warrior's shirt was frequently fringed with scalplocks. In cold weather and on ceremonial occasions a decorated robe was worn, while in warm weather or when engaged in active exertion the men were usually stripped to the G-string. The young children went entirely naked in warm weather. Among the plains tribes the investiture of a boy with the G-string occurred when he was about ten years old, and was an occasion of good-natured rejoicing in the family, as indicating that he was now considered old enough to accompany his older relatives on hunting or war expeditions. The Gulf tribes and those of the Southwest wore turbans of bright-colored woven stuff; but elsewhere, except in the extreme North, the head was usually bare. Some tribes west of the Rockies went practically naked. On the northwest coast the woman's dress was often of bark fibre. The Eastern moccasin was made in one piece; the plains moccasin had a separate sole of rawhide.

East of the Mississippi the men usually shaved the whole head, excepting for a crest along the top and a long scalp-lock plaited and decorated with various trinkets. This scalp-lock, the prize and trophy of the victor in battle, was universal east of the Rocky Mountains, and over a great part of the country westward, but seems to have been unknown in California. On the plains the men generally wore their hair its full length, in two long braids hanging down over the shoulders in front, with the scalp-lock behind. The Osage and Pawnee shaved the head, excepting the scalp-lock, while the Wichita and Apache let the hair flow loosely down the back. The Pueblo, Piute, and most of the California tribes usually wore it cut off in front above the eyes and at the shoulder-level behind. The Navaho bunched it into club shape. Women usually wore it flowing loosely. Those of the Sioux and Cheyenne wore it neatly braided at the sides. The Pueblo women cut it off at the shoulders and rolled it at the sides, while among the Hopi the unmarried women were distinguished by an extraordinary butterfly arrangement of the hair on each side of the head.

Head-flattening was practiced by the Choctaw and some of the Carolina tribes, and throughout most of the Columbia region. Labrets of bone were used by many tribes of the northwest coast. Nose pendants were common with a few tribes (hence the Nez Percé), while ear pendants with both sexes were almost universal. Tattooing was widespread, reaching its highest development among the Haida and others of the northwest coast, and the Wichita of the southern plains. Excepting with the tattooed tribes, painting was an essential part of full dress, colors and designs varying according to the occasion or the particular 'medicine' of the individual.

Necklaces of shells, turquoise, mussel pearls, or, among the Navaho, of silver beads, were worn, with breastplates and gorgets of shell or bone and bracelets of copper wire. Feathers and small objects supposed to have a mysterious protecting influence were worn in the hair, and the dress itself was profusely decorated with shell beads, elk-teeth, porcupine-quills, antelope-hoofs, and similar trinkets.

Dwellings and House-Building. North of the Pueblo region the general house plan may be described as circular. Among the Haida and others of the Alaskan coast, and extending down to the Columbia, the prevailing type was of boards, painted with symbolic designs and with the famous heraldic totem-poles, carved from cedar-trunks, standing at the entrance. Along the Columbia were found great communal houses. California had several distinct types, of which the dug-out and the dome-shaped clay-built house, entered from the top, were perhaps most common. The Piute, Apache, Papago, and others of Nevada and Arizona had the *wikiup*, an elliptical structure covered with reed mats or grass. The Navaho *hogán* was a circular house of logs, covered with earth, and entered through a short passageway. The square-built stone or adobe dwelling of the Pueblo marked the northern limit of the Mexican culture area. These *pueblos*, as they were called by the Spaniards, were aggregations of continuous rooms occupied by different families, so that the whole village sometimes consisted of but a single house, sometimes several stories in height. The roofs were flat, a projection of the lower wall within the room served for seats and beds, and the fireplace was in one corner, instead of in the centre, as was almost universal elsewhere. For better security against the wild tribes, the outer walls of the lower story were often without doors or windows, entrance being gained through trap-doors in the roof by means of ladders, which were pulled up at night. For the same reason, many of the pueblos, especially in ancient times, were placed upon high mesas, or on shelves on the sides of almost inaccessible cliffs, whence the name 'cliff-dwellers.' The prevailing type on the plains was the conical skin *tipi* (a word of Sioux origin), no other being so easily portable and so well adapted to withstand the violent winds of the treeless prairies. The Pawnee, Arikara, Mandan, and one or two other tribes living close along the Missouri River built earth-covered log houses, somewhat like those of the Navaho, but much larger. The Wichita in the south built stationary houses of grass thatch laid over poles. About the upper lakes was found the bark-covered *tipi*, while east and southeast was the *wigwam*, a rectangular structure of stout poles, overlaid with bark or mats of woven rushes, and in general form closely resembling a rounded wagon top. Among the Iroquois it became the communal 'long house.' In the Gulf States were found houses, either rectangular or circular, of upright logs plastered over with clay.

The Pueblo villages had underground *kivas*, or public rooms, where the men of the various secret orders made their preparations for the great ceremonials. It corresponded somewhat to the medicine lodge of the plains tribes, built of green cottonwood branches for the celebration of their annual sun-dance, while among the Gulf tribes its place was supplied by the circular log 'town house.' Some of the Eastern and Southern tribes had also dead-houses, temples, and public granaries. In general, an Indian village was a scattering settlement, but with many of the Eastern tribes the more important towns were compactly built and strongly stockaded.

Food, Agriculture, Hunting, Fishing. Excepting on the plains and in the frozen north, agriculture was the chief dependence of most of the tribes. Those on the coast, including the Haida, were naturally fishermen. Those of the upper lakes and about the head of the Mississippi planted little, but gathered large quantities of wild rice and cranberries, besides sugar which they boiled from the sap of the maple. The equestrian plains tribes, excepting the corn-planting Pawnee and Arikara, were hunters pure and simple. Those of the Columbia were salmon-fishers, root-diggers, and berry-gatherers. Those of California and the Sièrras were chiefly acorn and seed eaters. The Navaho, since the Spanish mission period, have lived principally by the flesh of their sheep and goats, while the predatory Apaches were expert in preparing the edible roots and petals of various desert plants. The Pueblos may be considered as purely agricultural, raising large quantities of corn, beans, squashes, and other vegetables, as well as chile and native tobacco. The tobacco was also cultivated by the Arikara and others of the upper Missouri, and by most of the Eastern tribes. Wild plums, pecans, mesquite beans, the tubers of the *pomme blanche*, and the seed-berries of the wild rose, were gathered and eaten by the buffalo-hunting tribes of the plains. Agriculture furnished more than half the food-supply of the Iroquois, the Atlantic coast and Gulf tribes, corn standing first in importance. In the arid Southwest irrigation was essential to success, and the Indians were skillful in utilizing the scanty water-supply in this manner.

Almost every animal of the plains and forest was hunted for its flesh, skin, horns, teeth, or sinew. On the plains the great game animal was the buffalo, after which came the elk, deer, and antelope. Very few Indians of this region ate the meat of birds or fish, although not averse to eating the horse or dog, while the Navaho and Apache refused to eat or even touch the bear, for some occult religious reason, and had an almost equal horror of fish. The Eastern Indians used fish, flesh, and fowl indiscriminately, only being careful not to put two kinds into the same pot. Salt procured from natural deposits or by boiling the water of saline springs was in general use on the plains and in the Southwest, as well as among some tribes of the Ohio Valley. In the Gulf States lye was used as a substitute.

Domesticated Animals. The horse and dog appear to have been the only animals regularly domesticated, although various birds were sometimes kept in confinement for the sake of the feathers, or possibly in some cases for their flesh. The Indian pony is commonly supposed to have descended from animals brought over by the Spanish conquerors; but some of the Western tribes stoutly assert that the horse was theirs long before the white man ever came. However that may be, it is now so much a part of the religious ceremonial, and daily life of the plains tribes that it is difficult to imagine a time when they were without it. Dogs frequently took the place of horses as light-burden carriers, and were likewise esteemed a choice article of food. The Caddo are said by other Indians to have trained their dogs to follow the trail of raiding enemies, possibly a trick learned from association with the French. The animal's main usefulness was as a vigilant sentry. From animals originally introduced by the Spanish Franciscans over two centuries ago, the Navaho now have more than 400,000 sheep and goats, from the wool and flesh of which they derive almost their whole subsistence.

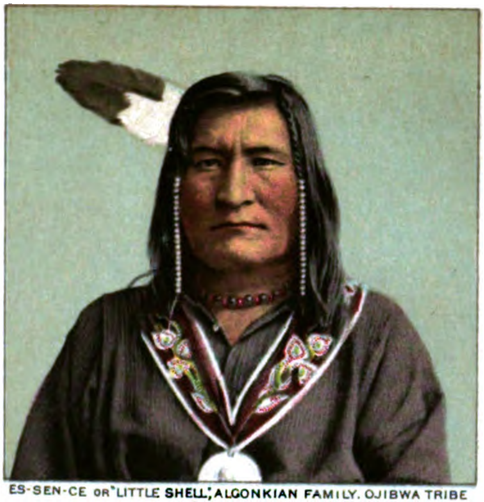
Industries and Arts. Aside from his food-procuring occupations, the Indian had quite a number of industries and arts, both economic and æsthetic. Having only accidental knowledge of any metal but native copper, his tools were made of stone, bone, shell, or wood.

From stone he fashioned his knife, hammer, axe, spear-head, and arrow-point, as well as his pipe and gaming disk. Flint was the material commonly used for cutting tools in the East and obsidian in the West. Pipes were of great variety and sometimes of great beauty, being one of the most important adjuncts of ceremonial functions. The Navaho and Pueblos were expert in drilling turquoise for necklaces and ear-pendants. The black slate carving of the Haida and other northwest-coast tribes is probably not excelled by any primitive people. Pots, bowls, mortars, and pestles were also fashioned from stone. Arrowheads, knives, skin-dressers, sewing-awls, and fishing-hooks were frequently made from bone. Shells were also shaped into cutting tools, but were in more constant demand for gorgets and for the celebrated wampum beads, which were in universal use in the East for dress ornamentation and for weaving into record belts. The Eskimo and Aleut were expert carvers in walrus ivory, depicting whole hunting scenes upon a single tusk, with great beauty of execution. Mortars, bowls, clubs, masks, and sacred images for ceremonial occasions were made of wood. The Pueblos carved wooden figurines to represent their traditional mythologic characters, and distributed them to the children as dolls at their symbolic dances. Besides the immense carved totem-poles, the northwest coast tribes hewed great canoes from cedar-trunks, always painted and carved in characteristic style. The wooden dug-out canoe of the Atlantic tribes was a similar affair.

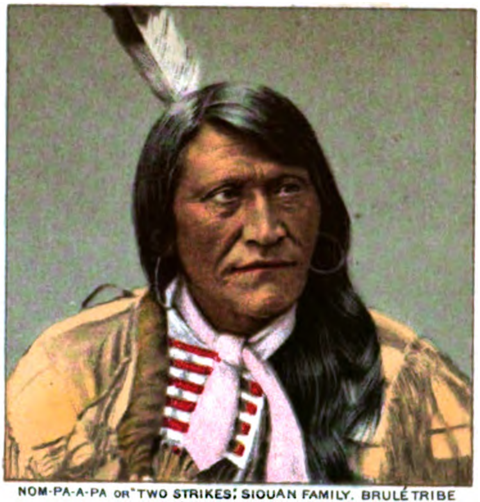
The Indian woman was a capable skin-dresser. Sinew was used for thread, and certain women were professionals in the work of cutting and fitting. Among the Pueblos and Navaho weaving had reached a high state of development, the material used having been originally a native cotton, and later wool. The art of feather-weaving was found with the Gulf tribes, while everywhere east of the Mississippi beautiful mats were woven from grass and rushes and stained in bright colors from native dyes. (See Blanket.) Basketry was found almost everywhere except upon the plains, where rawhide boxes formed a substitute. The materials used were wood or cane splits, rushes, maguey fibre, and grass. The art reached its highest development in California, the Pomo baskets being unrivaled in any part of the world for closeness of weaving, intricacy of design, and beauty of shape and decoration. (See Basket.) Akin to weaving and basketry was the art of decoration with beads and porcupine-quills, the most beautiful specimens being the cradles and colored sashes, on some of which months of labor were expended. Pottery was made by all the sedentary and semi-sedentary tribes of the Eastern timber region and the Southwest, the coil process being everywhere used. In the East the vessel was usually decorated with stamped patterns. Among the Pueblos and adjacent tribes figures in various colors were painted upon the smooth exterior and afterwards fixed in the firing process. Almost without exception the potter, basket-maker, weaver, and skin-dresser was a woman. The only metal really in use north of Mexico at the time of the discovery appears to have been copper, which was obtained native in small quantities in the Southern Alleghanies and in greater quantities from mines along the shores of Lake Superior. It was not smelted, but hammered into a great variety of useful and ornamental objects which passed from tribe to tribe in regular trade. Mica was quarried in western North Carolina for use in mirrors and gorgets, and beads and other small objects hammered out from gold nuggets or meteoric iron have been found in some of the Southern mounds. In the Southwest the Navaho have learned the smelting and forging arts from the Mexicans, and have now many expert silver-workers and blacksmiths, making beads, buttons, wrist-guards, rings, and belts from silver coins which they melt and shape in forges and molds of their own construction.

War. As in the tribal stage warfare is the chronic condition, so to the Indian war was the chief glory, scorn of death the highest virtue, and cowardice the greatest crime. Among extreme Northern tribes the principal weapons were the knife, club, and lance. To these were added farther south the bow and arrow, and the hatchet or tomahawk. The bow and arrow were practically universal, but the lance and shield as a rule were used only by the equestrian tribes of the open plains and the desert Southwest, the timber people finding them a hindrance to active move-

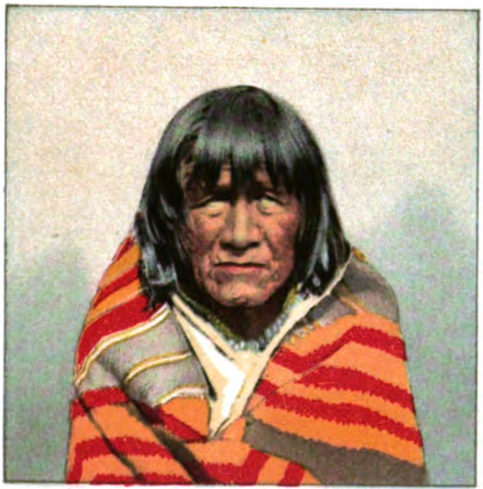
AMERICAN INDIANS



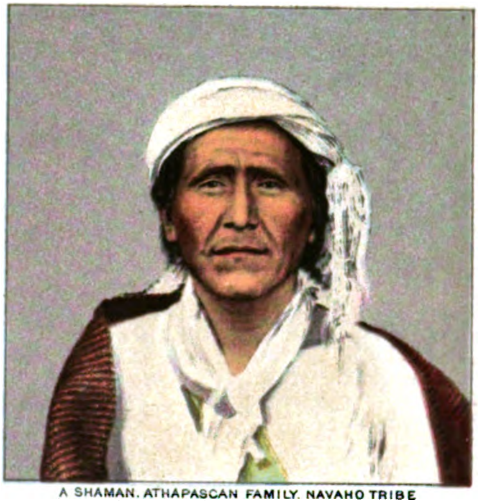
ES-SEN-CE OR "LITTLE SHELL," ALGONKIAN FAMILY. OJIBWA TRIBE
A FOREST INDIAN



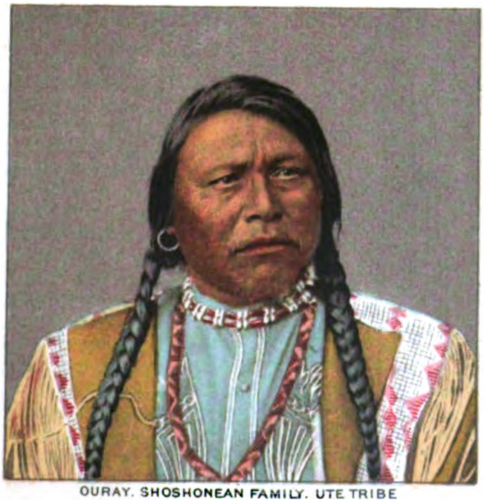
NOM-PA-A-PA OR "TWO STRIKES," SIOUAN FAMILY. BRULÉ TRIBE
A PLAINS INDIAN



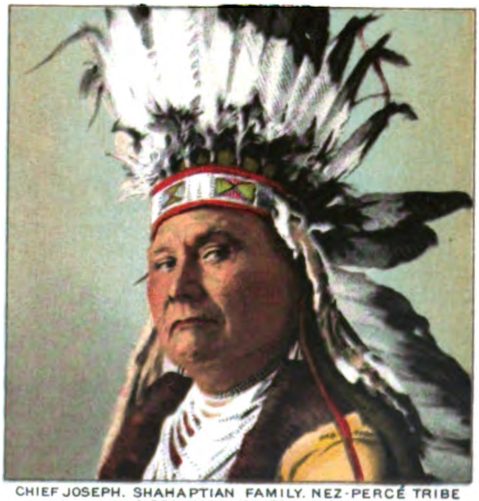
ARESO. KERESAN FAMILY. COCHITI TRIBE
A PUEBLO INDIAN



A SHAMAN. ATHAPASCAN FAMILY. NAVAHO TRIBE
AN INDIAN OF THE ARID REGION



OURAY. SHOSHONEAN FAMILY. UTE TRIBE
A MOUNTAIN INDIAN



CHIEF JOSEPH. SHAHAPTIAN FAMILY. NEZ-PERCÉ TRIBE
A COLUMBIA RIVER INDIAN.

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ment. Aside from the shield, defensive armor was not commonly used, excepting among tribes of the Alaskan coast, who had protective cuirasses of ivory plates, wooden slats, or of a very tough hide. The bow was selected wood, frequently reënforced with sinew along its entire length, and strung with a sinew cord. The Gulf tribes had also blowguns of cane for hunting. The club was of stone or wood, in the latter case being sometimes supplemented with a piercing blade of flint or iron. The shield of the plains warrior was of the toughest buffalo-hide, cut and decorated according to the spirit dream of the maker, and given to the recipient under the most solemn vows of lifelong tabus and sacred obligations.

In some tribes the direction of all that pertained to war belonged by hereditary right to certain clans or towns. Thus among the Creeks the privilege belonged to the people of the so-called 'red towns,' while on the other hand the 'white towns' had sole direction of peace negotiations. The prairie warriors had military orders with different degrees, the member being advanced from one to another by gradual steps. Thus the Kiowa had six orders, beginning with the 'Rabbits' or boys in training, and ending with a select body of ten tried and veteran warriors.

Service in any particular expedition was entirely a matter of individual choice, and the authority of the leader rested solely upon the voluntary obedience of his followers. On the plains the invitation was usually given by sending around a war-pipe, which every volunteer was expected to smoke. The going and the home-coming were attended with numerous ceremonies, and a successful campaign was celebrated with the scalp-dance, in which the women carried the captured scalps and sang the praises of the victors.

Indiscriminate massacre was the ordinary rule; but prisoners were frequently taken, either for torture, slavery, or adoption into the tribe. In the East the decision of the prisoner's fate was usually left to the women. If adopted, he was taken into a family and became thenceforth a full member of the tribe. If condemned to death, he met his fate with all the courage of his Indian training. On the plains captives were seldom tortured, but were more often taken into the tribe, being rarely, however, so completely admitted to membership as in the East. Along the Pacific Coast from Alaska to California regular slavery existed. The practice of scalping the slain enemy was probably universal north of Mexico, excepting among certain tribes of California, the scalp being kept as a trophy or offered in sacrifice to some tribal medicine. It was not, however, the only or even the chief evidence of the warrior's courage. His standing depended upon the number of his *coups* or brave deeds against the enemy, of which careful record was kept in the tribe. A man was entitled to 'count coup' (French, *a stroke*) not only for killing or scalping an enemy, but also for being the first to touch an enemy in the charge, for rescuing a disabled comrade, or for stealing a horse from a hostile camp. Thus three warriors might count coup upon a single slain enemy—viz. the one who killed him, the one who first touched the body with his coup-stick or weapon, and the one who secured the scalp. In many tribes it was customary to feast upon the flesh of one of the slain enemy after a notable victory.

AMUSEMENTS. The leisure of the Indian was taken up with athletic contests, games, dances, feasts, and story-telling. The ball-play was the chief athletic game everywhere east of the plains, as well as among some tribes of the Pacific Coast, the ball being handled with netted sticks somewhat resembling tennis rackets. From this game are derived the lacrosse and racquet of Canada and Louisiana. Next in importance in the East was the game known to the old traders as *chunkee*, played with a circular stone disk or wheel, and a pole curved at one end in the fashion of a shepherd's crook. The wheel was rolled by one of the contestants, while the other tried to slide the stick after it in such a way that the wheel would lie within the crook when both came to a stop. The plains tribes had a very similar game in which a netted wheel took the place of the stone disk. Foot-racing was common among the agricultural tribes, and horse-racing on the plains. The Wichitas had grand ceremonial races in which every person old enough to run participated. Dice games were universal.

A favorite pastime of the plains women was the awl game, played with marked sticks which were thrown down upon a stone set in the middle of a blanket, tally being kept by advancing an awl along certain marks around the margin of the blanket. Shinny and football were also played by the women. Hunt-the-button games were played within the tepee during the long winter nights, the players accompanying the movements of the hands with songs intended to distract the attention of the other side. Games of divination were also found among many tribes.

Dances, frequently preceded by purification rites and usually followed by feasting, were either social or ceremonial, and of great variety. Many were pantomimic, the performers wearing masks or other costumes intended to symbolize various animals or mythic characters, whose cries and actions they imitated.

Musical instruments were the drum, flageolet or flute, eagle-bone whistle, rattles of various kinds, and even a notched stick rubbed in saw fashion with one end resting upon a gourd for a sounding-board. The rattle was most commonly used in doctor's incantations and in the peyote ceremony, the whistle in the sun dance, and the flute to accompany the songs of the young men while riding about at night. There were songs for every occasion, lullaby, work, love, gaming, medicine, war, and ceremonials.

RELIGION AND MYTHOLOGY. To the Indian every animal, plant, and object of nature was animated by a spirit, beneficent or otherwise, according as it was propitiated or offended. Certain of these were regarded as especially powerful or active, as the sun, fire, and water among the elemental gods, the buffalo, eagle, and rattlesnake among the animals, and the cedar, cottonwood, corn, tobacco, and peyote among plants. The number four was peculiarly sacred, as having reference to the cardinal points. Colors had symbolic meanings, and sometimes also sex and local abiding-places. Thus with the Cherokee the red gods of victory lived in the Sunland or east, while the blue spirits of disaster dwelt in the north. Spirits were propitiated and implored with prayer, sacrifice, vigil, and fasting, and the purificatory sweat bath usually preceded every important ceremony. There was no overruling 'Great Spirit,' excepting as certain gods were of more frequent importance than others. Among the plains Indians the spirit buffalo was all-important, while with the agricultural tribes the rain-gods took precedence. The sun and its earthly representative, fire, were everywhere venerated. Certain tribes had tribal 'medicine' or palladiums, with which the nation's prosperity was supposed to be bound up and around which centred their most elaborate ceremonial. Thus the Kiowa had their Taime image of stone, the Cheyenne their sacred arrows, the Omaha their great shell. Each man had also his own secret personal medicine.

The priest was also a doctor, medicine and religion being so inseparably connected in Indian idea that there was usually but one word to designate both. The priests were frequently organized into cult societies, and there were also brotherhoods bound together by certain secret rites. Great stress was laid upon dreams and sacrifice. Among the Pawnee, in former times, a captive girl was annually sacrificed to the goddess of fertility. The cannibalistic practices of the Eastern tribes after a victory, and the cannibal feasts of the Northwest coast, in which a slave was the usual victim, were also more or less sacrificial in motive. With these exceptions human sacrifice was rare, such bloody rites as those of the Aztecs being unknown in the North. There were special ceremonies for girls at puberty, and for young men on first taking rank with the warriors. Among the great religious ceremonials may be noted the green-corn dance of thanksgiving for the new crops, among the Eastern tribes; the sun dance and the more recent ghost dance of the plains tribes; the salmon dance of the Columbia region, and the celebrated snake dance of the Hopi of Arizona. To these may be added the peyote cult of the Southern plains. Tribal religions were sometimes subject to revival or revolution as new prophets arose from time to time. Thus the religion of the ghost dance, which has practically superseded the old beliefs and ceremonial forms of the plains tribes, had its origin in Nevada about fifteen years ago.

Each tribe had its genesis tradition and its culture hero—usually a great trickster and frequently an anthropomorphic animal—together with giants, dwarfs, fairies, witches, and various monsters, as well as animal tribes and chiefs, concerning all of whom there was a great deal of myth and folk-lore. Certain stories must be told only in winter, and others only at night, in order not to offend the chief personages concerned.

Social Organization. Government was based upon the gentile or clan system everywhere excepting among certain tribes of the plains and the Pacific region, notably the Kiowa and Klamath. Under this system the tribe was organized into certain clans or gentes, the members of each clan being considered as so closely related to each other that intermarriage within the clan was forbidden. Children usually belonged to the mother's clan and descent was in the female line. Chiefship and certain civil and religious functions inhered in particular clans. Captives or other aliens must be adopted into a family and clan in order to become members of the tribe. These clans were commonly known by the name of some class of animals, e.g. bear, beaver, wolf, etc.; more rarely by plant or other designations. In other words, the clan was distinguished by a *totem*, as it is now universally called, and the totemic practices were inseparably tied up with their religious rituals and social organization. See Totemism.

Among the plains tribes generally the clan system was either absent or quiescent, the unit being the band, each band having its own appointed place in the camping circle at the great tribal gatherings, as for instance the annual sun dance.

In exceptional cases tribes combined into confederacies, sometimes accidental and temporary, at other times built up in steady pursuance of a definite policy, as among the Iroquois and Creeks.

Land was the common property of the clan, tribe, or confederacy, excepting in certain tribes of California and the northwest coast, where it is asserted that individual ownership existed. Game, timber, and other natural products were also free, and hospitality was so much a cardinal virtue that it might almost be said that everything which was not hedged in by some sacred tabu was common property within the tribe and might be had for the asking, or without it if there seemed need. While this system almost eliminated the individual pauper, it killed ambition and hindered advancement by making it impossible for any man to rise far above the general level. Accumulation was impossible, and even what property he might possess was usually destroyed at his death. The niggard was rated with the coward, and in some tribes a man rose to the highest rank of distinction by giving away all that he owned. Along the Lower Columbia and the northwest coast this public surrender of the savings of a lifetime was a recognized tribal custom known as the *potlatch*.

Slavery was a regular institution on the Pacific Coast from Alaska to California, the slaves being prisoners of war, their children and descendants, who thus constituted a permanent slave caste within the tribe, condemned to hard labor, harsh treatment, sale, or death at the will of their masters. Slavery of a milder type seems to have existed among the South Atlantic tribes. In more modern times the Southern Indians followed the example of the colonists, and became the owners of negro slaves.

Numerous societies existed for various purposes, military, religious, and social. The plains tribes had a custom by which two young men mutually agreed to become partners or 'friends' through life, the compact being sometimes ratified by a public exchange of names.

Woman, while subject to her husband in ordinary affairs and debarred from certain societies and ceremonies, had yet well-defined rights of her own. She was complete mistress in household affairs, and among the Eastern tribes had either a voice or a representation in councils. With the Iroquois all important questions must be passed upon by a council of the women, who alone had power to declare war. The right of adoption, which meant the decision of a captive's fate, rested also with the women. In general her position was highest in the agricultural tribes. In the division of labor most of the heavy work fell to her share, while the dangerous and arduous undertakings belonged to the man. Polygamy was recognized in most of the tribes excepting the Pueblos.

Burial. The method of disposing of the dead varied with the tribe and environment, inhumation being most common. Some tribes, as the Choctaw and Nanticoke, dug up the corpse after the flesh had had time to decay, and carefully cleaned the bones, to be kept thenceforth in a box in the cabin or deposited in a tribal ossuary. Some of the South Atlantic tribes preserved the mummified bodies in dead-houses. The Hurons exposed the bodies on scaffolds until the annual 'Feast of the Dead,' when all the bones were interred in a common sepulchre. Many of the smaller Eastern mounds were evidently built for sepulchral purposes. The Northern plains tribes usually deposited the bodies in trees or upon scaffolds. The Kiowa buried in the rocks. The Aleut of Alaska doubled the body into a compact bundle and laid it away in a sitting posture in a cave. Southward along the coast canoe burial was common. The Piute, Mohave, and others of the lower Colorado region practiced cremation.

Everywhere it was customary to bury or otherwise destroy the property of the deceased at the time of the funeral, and in many Eastern tribes food was placed beside the grave and a fire kept burning for four successive nights, the period supposed to be occupied by the soul in its journey to the land of shades. Laceration of the body and cutting off of the hair on such occasions was very common, especially on the plains, with wailing of the relatives for several weeks thereafter.

Language. The first attempt at classifying the North American languages was made by Albert Gallatin in 1836, the relationships being established chiefly by a comparison of word roots. The beginning of regular systematic research dates from the establishment of the Bureau of Ethnology, under Major J. W. Powell, in 1879. The number of linguistic stocks north of Mexico, as at present recognized by the bureau, is 57, as given below, but it is probable that more extended study will reduce this number by disclosing affinities as yet undiscovered.

Algonquian
Athapascan
Attacapan
Beothukan
Caddoan
Chimakuan
Chimarikan
Chimmesyan
Chinookan
Chitimachan
Chumashan
Coahuiltecan
Copehan
Costañoan
Eskimauan
Esselenian
Iroquoian
Kalapooian
Karankawan
Keresan
Kiowan
Kitunahan
Koluschan
Kulanapan
Kusan
Lutuamian
Mariposan
Moquelumnan
Muskhogean
Natchesan
Palaihnihan
Piman
Pujunan
Quoratean
Salinan
Salishan
Sastean
Shahaptian
Shoshonean
Siouan
Skittagetan
Takilman
Tañoan
Timuquanan
Tonikan
Tonkawan
Uchean
Waiilatpuan
Wakashan
Washoan
Weitspekan
Wishoskan
Yakonan
Yanan
Yukian
Yuman
Zuñian

The necessity for some common means of intercommunication was supplied by trade jargons, chief of which were the 'Mobilian language,' and the Chinook jargon, and by the sign language on the plains. Some tribes had made fairly successful attempts at recording their history and mythic traditions by means of pictographs. Of these the best-known are the Walam Olum of the Delaware, and the Kiowa calendars. Intertribal compacts were commemorated among the Eastern tribes by means of symbolic wampum belts. The Cherokee alone had a literature recorded in an alphabet of their own invention.

Population. The theory of a former large Indian population has been found to be erroneous, but on the other hand the frequent assertion that the Indian has held his own, or is even increasing, is equally incorrect. It must be remembered that the Indian of the discovery was a full-blood, while the officially recognized Indian of to-day may be full-blood, mixed-blood, white man, or negro.

The population varied according to the district, being naturally greatest along the coast, and in rich agricultural regions where the means of subsistence were most abundant. The best summarizing of trustworthy early writers would seem to make the original Indian population east of the Mississippi about 200,000. Beyond this we have no reliable data for any large area, although it may be noted that so careful an observer as Powers estimates the Indian population of California just before the gold discovery to have been greater than that of all the rest of the United States together. Some examples may serve to show the terrible decrease in almost every section since the advent of the white man, taking only tribes still in existence, and making no account of tribes and whole linguistic stocks which have utterly disappeared.

In 1701 Lawson crossed the Carolinas from Charleston to Albemarle Sound, meeting in his journey sixteen different tribes. Of these only two have any representatives to-day, viz. the Tuscarora and Catawba. The Tuscarora at that time were estimated at 1200 warriors. They number to-day, all told, perhaps 700, of whom probably not one-fourth could make a valid claim to pure blood. The Catawba, who about the first settlement of Carolina had 1500 warriors, were reduced by 1743 to 400 warriors, in 1775 to about 100 warriors, and now number altogether about 100 souls, of whom hardly a dozen are of pure blood. Furthermore, the Catawba themselves in 1743 represented all that were left of more than twenty broken tribes.

The tribes of the ancient Iroquois league, with the larger tribes of the Gulf States, the latter now constituting the five civilized tribes of the Indian Territory, seem to form exceptions to the general history of aboriginal extermination, their numbers now being apparently as great as at any previous era. The figures are deceptive, however, for the reason that an overwhelming majority of those now so enrolled are mixed-bloods—sometimes with but an infinitesimal proportion of Indian blood—adopted whites, negroes, or Indians of other tribes. Thus in 1890 the so-called 'Cherokee Nation' of 27,000 souls included 2000 adopted whites, 3000 adopted negroes, and about 1500 Indians of other tribes, while those of full Cherokee blood were estimated at not more than one-fifth of the remainder. Since then the rolls have been swelled by the compulsory admission of some 7000 claimants repeatedly repudiated by the tribal Government.

On the plains the decrease has been appalling. The confederated Mandan, Minitari, and Arikara in 1804 numbered nearly 8000 souls in eight villages. In 1900 they were 110 in one village. The Osage and Kaw at the previous date were estimated on good authority at 6300 and 1380 respectively. In 1900 they numbered 1781 and 217, including all mixed-bloods. The Pawnee numbered over 12,000 in 1834, 8400 in 1847, 3416 in 1861, 1440 in 1879, and 650 in 1900. The Tonkawa were estimated at 1000 in 1805, 700 in 1849, counted 314 in 1861, 108 in 1882, and now number but 51. The confederated Kiowa, Comanche, and Apache have decreased over 10 per cent. since 1890. The Navaho and Hopi, who as yet have remained almost undisturbed, seem to hold their own, but in California the native population has been almost wiped out. All that remain of some twenty tribes of the Oregon coast are now gathered upon Siletz reservation to the number of 482 in 1900, with the record for the year of 22 births and 31 deaths. On the North Pacific coast the Aleuts have dwindled within a century from an estimated 25,000 to a present 2000. The celebrated Haida, with 39 villages and 7000 souls in 1840, are now reduced to two villages with a population of but 600.

The chief destruction has been from changed conditions, new diseases and dissipation introduced by the white man. The present Indian population north of Mexico, according to the best official estimates, is approximately as follows: United States proper, 260,000; British America, 100,000; Alaska, 20,000; or a total considerably under 400,000 souls.

INDIANS OF MEXICO, CENTRAL AMERICA, AND WEST INDIES.

The tribes of Mexico and Central America exhibited every stage of culture from the brutish Cochimí and savage Seri to the civilized Maya, Tarasco, or Aztec, with their highly developed agriculture, architecture, and literature. From the Rio Grande to Panama some thirty linguistic stocks were represented, besides the Arawakan and Cariban tribes of the West Indies. From traditional and other evidence nearly all of the more important tribes of Mexico and Guatemala, including those of Piman, Nahuatlan, and Mayan stock, appear to have migrated from the north. The Otomí and Chinantec, however, appear to have antedated this movement and may properly be considered indigenous. There are shadowy traditions of earlier cultivated races, the Ulmec and Toltec, from whom the ruder Aztec acquired their first civilization, but it is difficult to decide whether these names belong to the domain of history or of myth. The roving tribes of the northern frontier seem to have been akin to the Apache, but have now so completely disappeared that even their affinity is not certainly established. The Comanche and Kiowa, as well as the Apache, made constant inroads from the north, penetrating as far down as Zacatecas. The destruction of the peaceable Carrizo tribes of the lower Rio Grande is chiefly due to these raids.

The tribes of the California peninsula, apparently of Yuman stock, were among the lowest of the human race, possessing every beastly instinct without even the savage virtue of bravery. The Seri of Tiburon Island in the adjacent gulf were but slightly higher in the scale, but earned respect by their determined defense of their territory against all intruders. Their southern neighbors, the Yaqui, were as much noted for their fighting qualities as for their superior industry and reliability. The Tarumari and other Piman tribes of the Sierra Madre, as far south as Jalisco, differ but little in general habit of life from the northern Pueblos. Physically they are dark and rather undersized. The Otomi of the central plateau were but little inferior in culture to the Aztec, by whom they had been subjected. The Chichimec of the same region, so long the subject of ethnologic conjecture, are now known to have been a definite people of distinct stock.

The Nahuatlan tribes which constituted the nucleus of the ancient Aztec Empire dwelt chiefly in the present states of Mexico and Puebla, the Aztec proper having their capital on the site of the present city of Mexico. Detached offshoots of the same stock were found as far south as Costa Rica. The empire included many tribes or nations of diverse stocks, but not all the cognate Nahuatlan tribes, even in the central territory, were under the rule of the Aztec, their bitterest enemies in fact being their neighbors and kinsmen, the Tlascaltec.

By reason of their military importance, the Aztec have been somewhat overrated. Their general culture, while high in itself, was not superior to that of the Tarasco or Zapotec, and was inferior to that of the Maya. In their social organization they had passed the matriarchal stage and reckoned descent and inheritance in the male line. The national prosperity rested upon agriculture. Land belonged to the clan and marriage was regulated by gentile laws. In architecture they had reached a high stage of advancement, the pyramid of hewn stone being one of the most characteristic features. They knew the secret of bronze, and were skillful workers in gold and copper, but stone implements continued in common use, particularly obsidian for cutting purposes. Their dress was of native cotton, woven and dyed in brilliant colors. They had an extensive pantheon with orders of priests and priestesses, and a ritual ceremonial, impressive but cruel and bloodthirsty in character, thousands of human victims being annually sacrificed to the god of war, and their flesh afterwards eaten by the multitude. Children of the higher classes were educated in public schools, where boys studied military science, writing, history, and religion, and girls were taught cooking, household work, weaving, and morals. There was a large native literature preserved in books written upon parchment or maguey paper, 24,000 bundles of this fibre being exacted as an annual tribute from the conquered tribes. The characters were ikonomatic, or partly ideographic, partly phonetic, upon the principle of the rebus. Their calendar recognized 365 days in the year.

In Southern Mexico were the Tarasco, Totonaco, Zapotec and Mixtec, all populous and civilized nations equal in culture to the Aztec, if not superior. They built houses of cut stone, brick, and mortar, planted fields and orchards, worked gold and copper—the Tarasco wearing complete body armor of wood plated with copper or gold—made beautiful inlaid pottery, and wove cotton garments and robes of bright-colored feathers. They had elaborate ritual religions, accompanied sometimes by human sacrifice, with calendar systems and hieroglyphic literatures like those of the Aztec tribes. The Totonaco, who practiced circumcision and head-flattening, claimed to have built the pyramid ruins of Teotihuacan, a few miles northwest from the city of Mexico. The wonderful ruins of Mitla are claimed by the Zapotec.

Passing by the ruder Zoque, Mixe, and Chinantec, and the more advanced Chiapanec, in Oaxaca and Chiapas, we enter the territory of the highly civilized Mayan tribes, who held the whole peninsula of Yucatan, with large portions of Tabasco and Chiapas and most of Guatemala, and had an outlying colony in the Huastec of Vera Cruz. Their principal nations, besides the Maya proper in Yucatan, were the Quiche and Cakchiquel of Guatemala. There is evidence that the ancient builders of Palenque and Copan, already in ruins at the time of the conquest, were of the same stock. The Maya proper had at one time formed a powerful confederacy, which, however, had broken up into a number of independent States before the arrival of the Spaniards, by whom they were conquered in detail, the last free remnant being driven from their citadel of Chan Santa Cruz by Mexican troops only as late as 1900, after a stubbornly contested war of several years. When first known, the great cities Mayapan, Uxmal, and Chichén-itzá, now in ruins, were flourishing centres of dense populations, which had attained the highest point of native American civilization. In government they retained a modified clan system, with an hereditary chief ruler, assisted by a council from his own clan. They were preëminent in architecture, building palaces, pyramids, and cities of cut and polished limestone, set in mortar and covered with figures and hieroglyphic inscriptions. Strange as it must seem, all this was done without metal tools, gold and copper being used only for ornamental purposes. Agriculture was the principal industry, the common lands being portioned out by the village chiefs. Honey and wax were obtained from domesticated bees, and an active commerce was carried on by sea along the southern Gulf coast as far as the island of Cuba, copper disks and cacao-beans being used as currency. Their intricate calendar, with its cycles of 20, 52, and 260 years, has been the subject of much scholarly interest, as also their remarkable hieroglyphic records, written upon parchment or maguey paper, or carved or painted upon the walls of their ruined cities, and for which as yet there is no interpreter. The cognate Cakchiquel and Quiche were similar to the Maya in culture, differing only in dialect and extent of territory and influence. The great *Popol Vuh*, a native compendium of the ancient mythology and history of the Quiche, translated by Brasseur de Bourbourg, has been characterized as "one of the most valuable monuments of ancient American literature."

Honduras, Salvador, Nicaragua, and Upper Costa Rica were occupied by tribes of different stocks, some of them of considerable advancement, others, particularly along the east coast, mere savages. The Xinca, on the Guatemala-Salvador frontier, are believed to have been a remnant of the pre-Mayan tribes. The Carib, on the Honduras coast, were exiles from the Antilles. The Mosquito, Ulva, and Rama, farther south along or near the coast, were all wild tribes of different degrees of savagery. The Ulva also have the custom of head-flattening. The Guatuso of northern Costa Rica were an agricultural but brave and savage people, now near extermination, owing to the cruelties of the rubber-gatherers. South of their territory were found tribes of higher culture grade, the northern outposts of the civilized Chibchan tribes of Colombia.

The whole of the West Indies, with the exception of two or three sporadic settlements from Florida in the Bahamas, was held by tribes of the two great South American stocks, Arawakan and Cariban, the former being indigenous, while the latter were recent invaders, who, at the time of the discovery, had as yet colonized only the southern islands. The Arawakan tribes were peaceful and agricultural, skillful weavers, wood-carvers, and stone-polishers, but unable to withstand the inroads of the more savage Carib.

Below is given a list, from north to south, of the linguistic stocks of Mexico, Central America, and the islands, so far as present limited study enables us to classify them, the Mexican portion being according to the latest researches of Dr. Nicolas Leon. The first five are extensions from the United States; the Cariban, Chibchan, and Arawakan are mainly in South America:

Yuman (Lower California, etc.).
Piman.
Athapascan (Chihuahua, etc.).
Tañoan (Chihuahua).
Coahuiltecan (Tamaulipas, etc.).
Maratinian (Tamaulipas).
Serian (Sonora).
Chichimecan.
Otomían.
Matlaltzincan (Mexico and Michoacan).
Nahuatlan.
Tarascan (Michoacan).
Totonacan (Vera Cruz).
Zapotecan (Guerrero, Oaxaca).
Chinantecan (Oaxaca).
Huavean (Oaxaca).
Zoquean (Oaxaca, Chiapas).
Chiapanecan (Chiapas, Nicaragua, Costa Rica).
Mayan.
Xincan (Guatemala).
Cariban (Honduras and islands).
Lencan
Xicaquan } (Honduras).
Payan

INDIANS OF SOUTH AMERICA.

Our acquaintance with the ethnology of South America is still very imperfect, for the reason that vast areas are yet unexplored, while in some regions brought under Spanish or Portuguese dominion so much confusion has been wrought by the migration, disintegration, or complete extermination of tribes that the writings of early missionaries or travelers help little to clear up the difficulties. Here, as wherever else the uncivilized man confronts the European, we find the same steady march toward extinction, brought about originally by wholesale massacres and cruelties at the hands of the white conqueror, and later by the new diseases which followed in his wake.

As in North America, we find also on the southern continent the phenomenon of vast areas occupied by tribes of some half-dozen linguistic stocks, differing little in habit and all upon nearly the same culture plane, with other areas of mountainous or otherwise difficult country held by a multitude of small stocks with habits almost as widely variant as their languages. In general we may group the tribes by three great regions, viz. the Andean, the Amazonian, and the Pampean, the first being the mountainous territory extending along the Pacific coast from the isthmus to about 35° south, in Central Chile; the second, the whole interior stretching eastward from the summit of the Cordillera to the Atlantic, with the exception of the Chaco; and the third, comprising the Chaco forest and the grassy plains of the Pampas, between the Andes and the Paraná River, together with Southern Chile, and stretching southward to Cape Horn.

In the Andean region we find the highest culture, represented by the Chibcha, Yunca, Aymara, and above all the Quichua, whose empire extended nearly two thousand miles along the coast and made its influence felt even among the wild tribes of the Upper Amazon and the Chaco border. In nearly all these nations we find a firmly established system of government, with social distinctions clearly defined; careful and successful agriculture, including irrigation and the use of manures; superior pottery, with curious designs found nowhere else; weaving of cotton and the hair of domesticated animals; beautiful metal-work in gold, silver, and bronze; and an architecture with such enduring monuments as the stupendous ruins of Gran Chimu, Paucartambo, and Tiahuanaco. So far as can be learned the various governments were based upon the clan system, even in Peru, where the Inca himself was but the executive officer of a council of the gentes. Of the various religious systems the best known is that of the Quichua, whose great god was the Sun, after whom came their culture hero, the white and bearded Viracocha. The dead were buried in the ground, deposited in stone sepulchres, or mummified and preserved thus in temples and caves. Anything in the nature of a hieroglyphic system appears to have been unknown, the nearest approach having been the *quipu* records of the Quichua. The descendants of these cultured Andean nations still number many millions, in fact constituting the bulk of the population over large areas, and although in theory accorded equal civil rights, they are yet, like aboriginal races elsewhere, in a state of practical vassalage to the dominant race of the conqueror.

The tribes of the Amazonian region, the Orinoco, and the Paraná, were all in various degrees of savagery, although nearly all sedentary and more or less agricultural in habit. Cannibalism prevailed extensively, the word itself being derived from the name of the fierce Carib tribe. The custom still exists on some of the southern headstreams of the Amazon. Living mainly under the tropics, many tribes were entirely naked, and tattooing and body-painting, although occasionally found, were rare. Labrets were worn by a number of tribes. Scalping was unknown, but several tribes, notably the Mundurucú, preserved the heads of their slain enemies. The blowgun and poisoned arrow were general throughout the Upper Amazon and Orinoco regions, curari poison constituting a chief article of intertribal trade. Government was of the loosest, and confederations were almost unknown. The prevailing religious form was a crude animism, apparently several degrees lower than that of the North American savages. Throughout this vast area the tribes which have not disappeared are still nearly in their primitive condition, excepting where devoted missionaries have gathered them into villages, chiefly in Peru, Bolivia, and Paraguay. The Jesuit missions among the Guarani are recognized as the most successful ever established in America. At one time they contained over 300,000 Christianized Indians, the basis of the modern civilized States of Paraguay and Uruguay.

The tribes of the northern and central Pampean region, including the Chaco and Pampas sections of Argentina, are warlike equestrian nomads and hunters, living in tents of skin, subsisting almost entirely upon meat, and in other respects also very similar to our own plains tribes, but superior in the possession of herds of cattle and sheep, as well as horses, and in a certain skill in iron-working. The Araucanians of Southern Chile, an extension of one of the most important Pampean stocks, have successfully maintained their independence both against the Inca emperors and the conquering Spaniard. The Patagonians resemble their northern neighbors of Argentina, but represent a somewhat lower grade of culture. Like them, they are brave fighters and of fine physique. The natives of bleak Tierra del Fuego are in perhaps the lowest stage of culture found in South America, occupying the merest temporary shelters, going almost naked even in coldest weather, and having no apparent tribal forms or ceremonials. On the other hand, they are skillful hunters and daring fishermen.

Below is given a tentative list of the existing South American linguistic stocks, numbering approximately sixty so far as present very deficient knowledge permits a classification, Brinton being the chief authority:

Alikulufan (Tierra del Fuego).
Andaquian (Colombia).
Arauan (Brazil).
Araucan or Aucanian (Argentina, Chile).
Arawakan (Brazil, Venezuela, etc., and islands).
Atacameñan (Chile).
Aymaran (Peru, Bolivia).
Barbacoan (Colombia).
Betoyan (Colombia, Venezuela).
Canichanan (Bolivia).
Carajan (Brazil).
Cariban (Brazil, Venezuela, Guiana, islands).
Caririan (Brazil).
Catamareñan (Argentina).
Cayubaban (Bolivia).
Changuinan (Colombia).
Charruan (Uruguay, etc.).
Chibchan (Colombia, Costa Rica).
Chiquitan (Bolivia).
Chocoan (Colombia).
Chonekan or Tzonecan (Patagonia).
Churoyan (Colombia).
Cocanucan (Colombia).
Cunan (Colombia).
Guahiban or Guayban (Colombia).
Guaraunan (Venezuela).
Guaycuran (Argentina, etc.).
Itonaman (Bolivia).
Jaruran or Yaruran (Venezuela).
Jivaroan (Ecuador, etc.).
Laman (Peru).
Lulean (Argentina).
Mainan (Ecuador, etc.).
Matacoan (Argentina, Paraguay).
Mocoan (Colombia).
Mosetenan (Bolivia).
Moviman or Mobiman (Bolivia).
Onan (Tierra del Fuego).
Otomacan (Venezuela).
Paniquitan (Colombia).
Panoan (Peru).
Payaguan (Argentina).
Peban (Peru, Ecuador, etc.).
Piaroan (Salivan?)—(Colombia, Venezuela).
Puinavian (Colombia).
Puquinan (Peru).
Quichuan or Kechuan (Peru, Ecuador, etc.).
Salivan (Piaroan?)—(Venezuela).
Samucuan (Bolivia).
Tacanan (Bolivia).
Tapuyan (Brazil, Colombia).
Ticunan (Brazil).
Timotean (Venezuela).
Tupian (Brazil, Bolivia, etc.).
Yahganan (Tierra del Fuego).
Yuncan (Peru).
Yusucasan (Bolivia).
Zaparoan (Ecuador).

INDIAN SARSAPARILLA, NUNNARI-ROOT. The roots of Hemidesmus Indícus, an East Indian shrub of the natural order Asclepiadaceæ, used as a substitute for sarsaparilla.

INDIAN SUBREGION. A zoögeographical district of the Oriental Region, comprising India from the valley of the Indus eastward to the delta of the Brahmaputra, and southward nearly to its terminus, where it mingles with the Ceylonese Subregion, which includes Ceylon and the extremity of the Indian Peninsula. It is rich in animal life, which, as a whole, is Oriental in its affinities. The Mediterranean (Palearctic) Subregion seems to extend eastward to the arid valley of the Indus, and India thus possesses several Ethiopian forms, which have led some zoölogists to regard its fauna as Ethiopian rather than Oriental, but the weight of opinion has turned against this view. The eastern shore of the Bay of Bengal is the home of so mixed an animal population that it has sometimes been called an 'Indo-Malayan' subregion, but this is not generally recognized. Northeastern India, along the midslopes of the southern Himalaya ranges, is very different, faunistically, from the peninsular plains or the low hot coastal regions, owing to its elevation, and forms a long westward-reaching tongue of the Indo-Chinese and Manchurian subregions (q.v.). See maps under DISTRIBUTION OF ANIMALS; and the paragraph on *Fauna*, under INDIA.

INDIAN SUMMER. A short season of pleasant weather in the Central and Atlantic Coast States, usually occurring in October or November, more rarely in December, and characterized by an almost cloudless sky, calm or light airs, a hazy atmosphere, and mild temperature in the daytime, but rather cool at night. It may last one or two weeks, and may recur two or three times during a season, but rarely more than twice. During Indian summer weather the barometer stands above the average, and the cloudless sky indicates that there is in general a descending tendency of the air at some distance above the earth. Balloons ascending to great heights show that there is very little horizontal movement in the air, but what there is is toward the east. At this season the leaves of most plants dry up and drop away, adding their débris to the dust in the atmosphere. Owing to the prevailing dryness, forest fires and prairie fires occur at this time, and the smoke adds to the intensity of the Indian summer haze, but is not necessarily the sole cause of it. Frequently such smoke spreads slowly eastward, gathers moisture to itself, and is followed by clouds and gentle rain. Precisely similar weather occurs in Germany, where it is known as the 'Old Woman's Summer' and 'Saint Luke's Summer,' and in England, where it is known as 'Saint Martin's Summer,' or 'All Hallow Summer'; these terms being applied to it according to the various dates on which it happens to occur in October or November. There are also many indications of its existence in China and Siam. The haze attending the African Harmattan in December and January appears very similar to that of Indian summer, but the diatom dust that characterizes the former has not yet been found in the latter.

As to the origin of this expression, Mr. Albert Matthews has shown that it does not occur anywhere either in printed books or manuscripts until the year 1794; but at that time it was in use throughout the Atlantic States. The popular belief that Indian summer weather was predicted by the native Indians in conversation with the first European settlers finds no documentary corroboration, and the idea that the term Indian summer was employed by the early settlers seems to be a myth. In general, neither this term nor anything corresponding to it is to be found in any Indian language. The term Indian summer in its present usage was introduced into England from America. In 1778 Horace Walpole used the same expression, but he evidently had in mind the intense heats of the midsummer weather in India and the West Indies. For full information on the whole subject, see the *Monthly Weather Review*, vol. xxx., pp. 19-29 and 69-79 (Washington, 1902).

INDIAN TERRITORY. A former Territory of the United States, situated nearly in the middle of the country. It was bounded on the north by Kansas and Oklahoma, on the east by Missouri and Arkansas, on the south by Texas, and on the west by Oklahoma. Its area was 31,209 square miles, including 419 square miles of water.

Because the Indian Territory had been reserved for Indian tribes, it long remained practically unexplored, while the areas around it were surveyed and well mapped. A curious illustration of the fact that little was known about this large region was afforded by the survey of the lands of the Territory authorized by the National Congress in 1894. It had been assumed that the Territory was mainly an open, flat country, and that the survey might therefore proceed very rapidly. It was found, however, that about one-fourth of the Territory is mountainous, and that nearly two-thirds is woodland. As late as 1895 it appeared that while good maps of the drainage of the Chickasaw reservation had been prepared, its relief was not yet mapped; and that little was known either of the drainage or relief of the remainder of the Territory.

Various parts of the Territory differ much in their topography. South of the Canadian River, in the reservations of the Choctaw and Chickasaw nations, the country is considerably broken, being traversed by the winding serpentine ridges forming the southern part of the Ozark Hills. These hills enter the Territory from Arkansas, and the summits near the Arkansas boundary reach an altitude of 2500 feet above the sea. Farther south they diminish in height till, in the middle of the Choctaw reservation, they are not more than 1000 feet above the general level of the country. The rocks of these ridges are, for the most part, quartzite, while the valleys between them are floored with limestone. This difference in the rock formations explains the topography. The quartzite ridges are the survival of the hardest rocks.

The northeastern part of the country, north of the Arkansas and Canadian rivers, is a plateau deeply scored by streams. West of this very broken region the Territory is broadly undulating. The eastern portion of the Territory, particularly in the hilly and mountainous regions, is heavily timbered. The southern part, including the Chickasaw reservation and the western portion of the Choctaw country, is a territory of timber and prairie, the timber predominating to the extent of nearly three-fourths of the area. The largest extent of prairie is in the Cherokee and Creek reservations of the north, where there is little timber except along the streams between the timber belt on the west and the hilly country on the east. Some Azoic rocks are found in the north, and the igneous rocks of the hilly and mountainous areas are above mentioned, but the predominant geological formation is Carboniferous; in this formation are the bituminous coal measures. Coal is mined most largely in the southeast and is yielding nearly 3,000,000 tons a year, most of the product being marketed in the Southern States. The output of petroleum increased very rapidly from 6472 barrels in 1900 to 712,000 barrels in 1904. Gold and silver are also found in the mountain regions, and asphalt has been discovered, but is not yet of much importance.

As the drainage of the Territory shows, the general slope of the land is gently from northwest to southeast. The streams are numerous, but none of them is important for navigation. The Red River flows along the boundary of Indian Territory and Texas. The Canadian River, rising in New Mexico, flows east nearly across the Territory till it joins the Arkansas. The Washita River, emptying into the Red River, drains most of the southwestern part of the country. The Arkansas, passing through the Territory, and the Red River carry off all the drainage.

The whole Territory belongs to the humid area of the eastern half of the United States, with sufficient, though not superabundant, rainfall for agriculture. Lying, however, between the 33d and 37th parallels of latitude, the region has a warm climate, the main annual temperature being about 60° F. For FLORA and FAUNA, see those sections under UNITED STATES.

AGRICULTURE. The Territory has the advantages of excellent natural conditions for the development of agriculture. The soil is fertile, and the rainfall is greater and more certain than it is in Oklahoma Territory to the west. In 1900, 36.6 per cent. of the land was included in farms. Most of the farms are owned by Indians, but there are also a number of negroes who own land, and also a certain number of whites who have secured land, principally by being adopted as citizens by act of the legislatures of the several Indian nations. However, the Indians do not, as a rule, cultivate their own farms, but rent them instead to the whites, the latter constituting seven-ninths of the total number of farmers. The average size of farms varies from 42.5 acres in the small Seminole Nation, to 329.2 acres in the Creek Nation.

The climatic conditions are such that a great variety of products, including those of both the temperate and semi-tropical regions, can be grown. The cultivation of the soil has thus far, however, been largely subordinated to stock-raising, and corn has consequently been the leading crop, comprising, in 1905, 1,905,131 acres. The areas devoted to wheat and oats for the same year were, respectively, 270,261 and 201,607 acres, while the tame hay and forage crops exceeded 45,000 acres. Cotton produces abundantly and is rapidly becoming of great importance, the acreage devoted to its cultivation in 1905 being 816,638. Fruits and vegetables are also very successfully grown. The prairie lands of the Territory afford excellent and extensive pasturage for stock. The number of cattle in 1905 exceeded 580,000. In the same year the horses numbered 213,234; mules, 53,648; sheep, 28,419; and swine, 751,352.

MANUFACTURES. Because of peculiar local conditions, especially the nature of the population, manufacturing has been slow to develop in Indian Territory. However, a good beginning has been made. The census of 1900 showed 789 establishments, with 1714 wage-earners, and products valued at $3,892,181. Of these establishments 179, with 1087 wage-earners, and products valued at $2,629,067, are comparable with the class of establishments included in the census of 1905, when the number of establishments was 466, the number of wage-earners 2,257, and the value of products $7,909,451. The most important industries are flour and grist milling, the manufacture of cottonseed oil and cake, printing and publishing, and the manufacture of lumber and planing-mill products. The greatest activity centres in the Chickasaw nation.

TRANSPORTATION. The railroad facilities are adequate enough for a higher industrial development than that which now prevails in the Territory. In 1905 there were reported 2686 miles. The principal lines are the Missouri, Kansas and Texas; the Saint Louis and San Francisco; the Choctaw, Oklahoma and Gulf; the Santa Fe and the Rock Island.

FINANCE. Under the tribal form of government, the different nations levied taxes on non-citizens and those employing non-citizens. Other important sources of revenue were the royalties on mineral products and the interest on funds held in trust by the United States Government. The Indian Agent collected and disbursed the tribal funds.

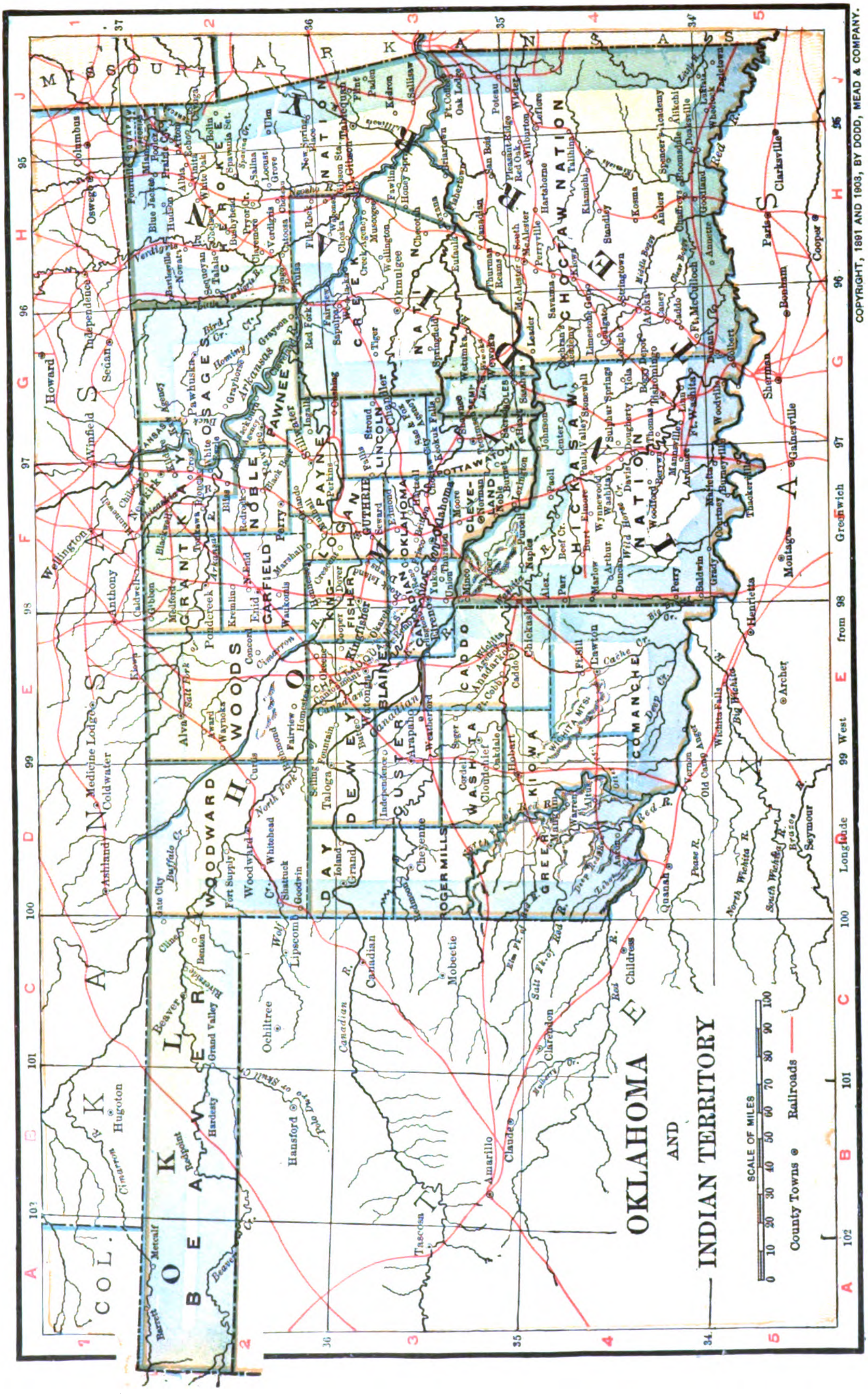
BANKS. April 6, 1906, there were 144 national banks, with loans amounting to $15,274,235; cash, etc., $1,008,228; capital, $6,018,110; and deposits, $14,130,495. The 57 state banks, June 30, 1905, had in loans, $1,734,579; capital, $1,253,425; and deposits, $1,611,398. There were also three private banks.

RELIGION. Missionary work among the Indians of the Territory has always been very active. The Methodists and the Baptists are in the majority; Presbyterians, Roman Catholics, Disciples of Christ, Friends, and other denominations are represented.

EDUCATION. Religious denominations, the National Government, and the tribal governments all maintain schools within the Territory. The Territory rapidly filled up with a population of whites, who, having no voice in the government, were unable to secure public school advantages for their children. A recent act of Congress enabling towns to incorporate, elect officers, and provide education for white children, was a particular relief. For a time the Indians were allowed to manage their own educational affairs. This was so unwisely, if not corruptly, done that Congress provided in the Curtis Act (1898) that the National Government assume charge, and accordingly a superintendent of education was placed in authority over the Five Nations (the Seminoles excepted). In 1904 the school population was estimated at 162,641, of whom 38,422 were enrolled in public schools, with an average daily attendance of 23,053. There were five public high schools with an enrollment of 867, and five sectarian high schools with an enrollment of 873.

POPULATION. The population of the Territory grew from 180,182 in 1890 to 392,060 in 1900, and to 700,000 (federal est.), in 1905. This great increase was due to the inflow of whites from the States. The Indians in 1900 numbered 52,510; and negroes, 36,870.

INDIANS. The Indians of the Territory consist of the 'Five Civilized Nations,' and those of seven reservations. Ninety-seven per cent. of the population, including whites, is found in the four prin-



OKLAHOMA AND INDIAN TERRITORY

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AREA AND POPULATION OF OKLAHOMA BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Beaver	A 2	Beaver	5,739	2,674	3,051
Blaine	E 3	Watonga	941	.....	10,658
Canadian	F 3	Elreno	803	• 7,158	15,961
Cleveland	F 3	Norman	545	6,605	16,388
*Comanche	E 4		....	.....	......
Custer	D 3	Arapaho	1,001	.....	12,264
Day	D 3	Grand	1,044	.....	2,173
Dewey	D 3	Taloga	1,008	.....	8,819
Garfield	F 2	Enid	1,086	.....	22,076
Grant	F 2	Pondcreek	1,004	.....	17,273
Greer	D 4	Mangum	2,393	5,338	17,922
Kay	F 2	Newkirk	895	.....	22,530
Kingfisher	F 3	Kingfisher	891	8,332	18,501
*Kiowa	D 4		....	.....	......
Lincoln	F 3	Chandler	961	.....	27,007
Logan	F 2	Guthrie	749	12,770	26,538
Noble	F 2	Perry	631	.....	14,015
Oklahoma	F 3	Oklahoma	713	11,742	25,854
Pawnee	G 2	Pawnee	542	....	12,366
Payne	F 2	Stillwater	759	7,215	20,909
Pottawatomie	F 3	Tecumseh	790	.....	26,412
Roger Mills	D 3	Cheyenne	1,191	.....	6,190
Washita	D 3	Cloudchief	988	.....	15,001
Woods	E 2	Alva	2,749	.....	34,975
Woodward	D 3	Woodward	3,295	.....	7,469
Kaw Indian reservation	G 2		...	.. ..	768
Kiowa, Comanche and Apache Indian reservation	....	Anadarko	4,643	.....	4,968
Osage Indian reservation	G 2		2,298	.....	6,717
Wichita Indian reservation	....		988	.....	1,420

* Organized since the last census was taken.

AREA AND POPULATION OF INDIAN TERRITORY.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Cherokee Nation	H 2		7,133	. ...	101,754
Chickasaw Nation	F 4		7,826	.....	139,260
Choctaw Nation	G 4		579	.....	99,681
Creek Nation	G 3		4,843	.....	40,674
Seminole Nation	G 3		10,910	.....	3,786
Modoc Indian reservation	J 2		210	.....	140
Ottawa Indian reservation	J 2			.....	2,205
Peoria Indian reservation	J 2			.....	1,180
Quapaw Indian reservation	J 2			.....	800
Seneca Indian reservation	J 2			.....	970
Shawnee Indian reservation	J 2			.....	297
Wyandotte Indian reservation	J 2			.....	1,213

cipal nations. By the enumeration of 1905, the Five Tribes comprised 91,337 persons,—36,482 Cherokees, 25,116 Choctaws, 15,923 Creeks, 10,767 Chickasaws, 3049 Seminoles. Of these only 25,000 are full bloods, 20,000 are negroes or of mixed negro blood, while 44,000 are of mixed Indian and white blood, and 2000 are whites adopted through intermarriage. The majority of the negroes enumerated are ex-slaves of the Indians, or descendants of ex-slaves, and share with the Indians in the allotment of lands. A non-citizen marrying into a tribe is made a citizen, and also receives an allotment of land. The Quapaw agency comprised seven small reservations, aggregating only 1700 persons.

Government. The 'Five Civilized Nations' (the Cherokees, Creeks, Chickasaws, Choctaws, and Seminoles), who occupy almost the whole of the Territory, came thither under an agreement with the United States guaranteeing their tribal authority. They organized for themselves forms of government much like those of the States, having a Governor, Senate, and Legislature, elected by popular vote, a national court, school system, and treasury. Under this independent, self-governing system the Five Nations have lived until recent years. The workings of the system were quite tolerable in the early period, but it is quite inadequate on account of the rapid changes in conditions now taking place. The white population of the Territory found themselves without a voice in the government, unable to secure such privileges as look toward their proper protection and development. Accordingly, various enactments were passed by Congress, all having for their ultimate purpose the extension of complete Federal jurisdiction over the Territory, the extinction of Indian governments, and the opening of the country to unrestricted white settlement. In 1893 a commission to the 'Five Civilized Nations,' the Dawes Commission, was appointed to enter into negotiations with the Indians in the Territory for the allotment of their lands in severalty, or to procure a cession of their lands to the United States. The Commission had by 1901 finally secured from each of the five tribes tentative agreements, looking toward allotment and citizenship. The work of the Commission was then pushed forward with noteworthy rapidity, and by June 30, 1905, when the commission was discontinued, the work of allotment had been practically completed. An act of 1897 gave the United States courts jurisdiction within the Territory. The Curtis Act of 1898 had for its general purpose the transfers of the control of property rights from tribal authority to that of the United States. Accordingly, it provided, among other things, for the enrollment of citizens, preparatory to the allotment of lands, for the regulation of town sites, and the incorporation of towns; and it gave the President a veto power over acts of the tribal governments. The change from communal to individual ownership was to take place formally on March 4, 1906. But just previously to that date Congress provided for the continuance of the tribal governments. The agitation for statehood, begun in 1892, led to the adoption of a constitution by a convention held in the summer of 1905, and an almost unanimous vote in November, 1905, in favor of separate statehood. In line with these actions a bill was introduced in Congress providing for the admission of Indian Territory as a separate State. But Congress, favoring the joint statehood of Oklahoma and Indian territories, passed the Statehood Bill in June, 1906. (See Oklahoma.) Consult: Hinton, "The Indian Territory, Its Status, Development, and Future," in *Review of Reviews*, vol. xxiii (New York, 1901).

INDIAN TOBACCO. See Lobelia.

INDIAN TURNIP. See Arum.

INDIAN YELLOW, or Purree. A coloring matter highly esteemed by artists. It is exported from the East Indies and China in spherical masses, which are of a dark brown color externally, but of a bright orange yellow in the interior. It is obtained in Bengal as a sediment from the urine of cows fed on decayed and yellow mango leaves. Its odor is peculiar, and resembles that of castoreum. It consists chiefly of the magnesium salt of an acid termed *purreic* or *euxanthic acid* ($C_{19}H_{16}O_{10}$). Alkaline solutions dissolve this acid, and form a yellow liquid. A solution of euxanthate of potash, when mixed with the solutions of the salts of the earths, gives brilliant yellow, sparingly soluble precipitates, and with acetate of lead it forms an insoluble yellow. Purree is often found adulterated with chrome yellow.

INDIA-RUBBER. See Rubber.

INDICATOR (Lat., pointer). In steam engineering, an instrument to measure and to record by means of a diagram the pressure of the steam in the cylinder of an engine. The indicator was invented by James Watt, of steam engineering fame, and the modern indicator is merely a structural modification of Watt's original design. Concisely described, the modern steam-engine indicator consists first of a small cylinder having communication with the interior of the engine cylinder by means of a short pipe provided with a stopcock. In this small cylinder works a piston having a piston-rod extending out of the top of the cylinder. This piston is normally pressed down to the bottom of the cylinder by a spiral spring, but when steam is admitted below the piston by opening the stopcock previously mentioned, the pressure forces the piston upward against the spring, compressing it a greater or less amount, according to the steam pressure. The top of the piston-rod is attached to a lever which carries a pencil at one end.

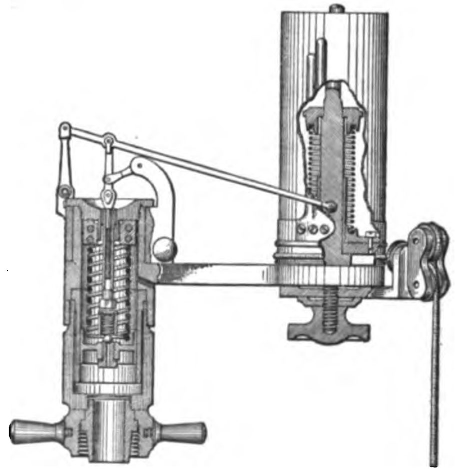

Fig. 1. STEAM-ENGINE INDICATOR.

This pencil bears against a slip of paper attached to a drum, which rotates back and forth on its axis for a distance and with motion which corresponds exactly to the stroke and movement of the engine piston. In operation the indicator piston rises and falls with the rise and fall of the steam pressure in the cylinder, and the pencil point is thus given a vertical movement whose magnitude corresponds to the intensity of the steam pressure. At the same time the rotation of the drum gives the paper a horizontal movement under the pencil point, corresponding in magnitude and speed to the engine-piston movement, so that the result of the two operations is the inscription of a loop-shaped diagram on the paper. These diagrams enable the steam engineer familiar with their use to calculate the power of the engine, to examine and adjust the actions of the engine valves, and to make certain inferences concerning the transformation of heat into work, and the influence of the metal of the cylinder on that operation. A concise treatise on the subject of indicators and indicator diagrams is Peabody, *The Steam Engine Indicator* (New York, 1900).

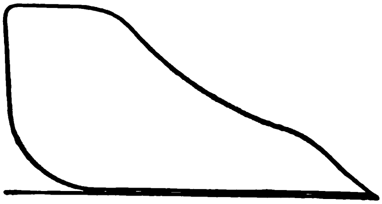
FIG. 2. INDICATOR DIAGRAM.

INDICTION, ĭn-dĭk′shŭn (Lat. *indictio*, imposition of a tax, period of fifteen years, from *indicere*, to declare, from *in*, in + *dicere*, to say, Skt. *diś*, to show). A period or cycle of fifteen years, the origin of which is involved in obscurity. It began to be used in reckoning time, chiefly by ecclesiastical historians, during the life of Athanasius; it was afterwards adopted by the Popes, through whose influence it came to be so generally employed during the Middle Ages, that the dates of charters and public deeds of this period are expressed in indictions as well as in years of the Christian Era. The time from which reckoning by indictions commenced is, according to some, September 15, 312; according to the Greeks of the Eastern Empire, September 1, 312; but when this method was adopted by the Popes, it was ordered to be reckoned as commencing January 1, 313. The latter, which is now alone used, is called the Papal indiction. If we reckon backward to the commencement of the Christian Era, it will be seen that 1 A.D. does not correspond to the first, but to the fourth year of an indiction—hence, if to any given year of the Christian Era three be added, and the sum divided by fifteen, the quotient will give the position of that year in an indiction—e.g. 1880 A.D. was the eighth year of an indiction.

INDICTIO PASCHALIS, ĭn-dĭk′shĭ-ō păs-kā′lĭs (Lat., Easter declaration). A custom that arose in the early Christian Church of Alexandria of announcing on Epiphany the days on which Easter would fall. Later this declaration was called the *Indictio festorum mobilium*, the announcement of the movable feasts, because the time when these should be celebrated depended upon the appointment of the days for Easter. The custom soon became general; the fourth Synod at Orleans (541) issued a formal order for the observance in its first canon.

INDICTMENT, ĭn-dīt′mĕnt (from OF. *enditer*, *endicter*, *inditer*, *indicter*, to accuse, Latin *indictare*, frequentative of *indicere*, to proclaim, from *in*, in + *dicere*, to say, Skt. *diś*, to show). The formal written accusation of crime against a person, presented on oath by a grand jury (q.v.), and upon which he is tried by a petit jury. In Scotland an indictment is also the accusation on which a prisoner is tried; but it runs in the name of the lord advocate, addressed to the prisoner. In England a prisoner is not entitled, before trial, to a copy of the indictment or a list of the witnesses against him except in case of treason. An indictment differs from an information (q.v.) in that it is the act of a grand jury, while an information is the written accusation of crime by the law officer of the Crown or of the State. It differs from presentment (q.v.) in that the latter is an accusation by the grand jury of its own motion, and without any charge of crime, or any bill of indictment being laid before it.

In the United States persons who are accused of felonies or grave misdemeanors can be brought to trial only upon an indictment which a grand jury has declared to be 'a true bill.' When a criminal court is convened, and the grand jury has been duly constituted and instructed, the State's attorney, or some other duly qualified officer, lays before them drafts of indictment against the alleged offenders, and furnishes them with the names of the witnesses whose testimony is relied upon to support the accusation. These witnesses the grand jury examines *ex parte*, not to determine the guilt or innocence of the accused, but to ascertain whether there is or is not *prima facie* evidence of guilt sufficient to warrant their trial. If twelve or more members of the grand jury pronounce in the affirmative, the presentment, with the words 'a true bill' indorsed upon the back thereof, is sent to the court; and, upon the charges therein contained, carefully set forth in the indictment subsequently prepared, the accused is put upon trial before a petit jury. The indictment is prefaced by a 'caption,' in which are set forth the name, term, and place of meeting of the court, the names of the justices, and the fact that the grand jury was lawfully constituted. Then comes a full and particular description of the alleged crime; the name of the accused must be given if known; and if not, he must be described in such a way as to make his identity sure. The time and place of the commission of the crime must also be stated, though it is not always necessary to conviction that these particulars should be exactly supported as charged. In some cases, however, a failure upon this point is fatal to the indictment. In trials for perjury the exact day when the offense was committed must be named. To prove that the crime was committed on some other day will not avail. In cases of murder the death must be described as occurring within a year and a day of the time when the alleged fatal injury was inflicted. When several persons have been concerned in the commission of a crime, they may be indicted either jointly or separately. It is usual to describe the alleged offense in different ways, in what are usually called 'counts,' in order to cover any uncertainty that may exist beforehand as to the precise way in which it was committed. It is enough if the prisoner is convicted upon a single count. The indictment must charge explicitly whatever is necessary to constitute the offense. In many of our States the harsh rule of the common law, which denied the right of a person accused of treason or felony to have a copy of the indictment, has been abolished by statute. Consult: Pike, *History of Crime in England* (London, 1876); Stephens, *History of the Criminal Law of England* (London, 1883); Pollock and Maitland, *History of English Law* (2d ed., London, 1899); *United States Constitution, Fifth Amendment.*

INDIFFERENTISM (from *indifferent*, from Lat. *indifferens*, not different, from *in-*, not + *differre*, to differ, from *dis-*, apart + *ferre*, to bear). A term used in philosophy and ethics, to designate the theory that the human will is absolutely indifferent to all motives. The doctrine is also called indeterminism or the doctrine of the liberty of indifference, and is opposed to determinism (q.v.). See FATALISM; ETHICS; WILL.

INDIGESTION (from Lat. *indigestio*, indigestion, from *in-*, not + *digestio*, digestion, from *digerere*, to digest, from *dis-*, apart + *gerere*, to carry), or DYSPEPSIA. A term somewhat vaguely applied to various forms of disease of the stomach or of the small intestines in which the natural process of digesting and assimilating the food is deranged. The common cause of indigestion, where organic disease is absent, is the eating of too much food, too rapidly, or without sufficient mastication.

The symptoms of indigestion are by no means constant in all cases. There is often *anorexia* (or want of appetite), but occasionally the appetite is excessive, and even ravenous. Nausea not infrequently comes on soon after a meal; while in other cases there is no nausea, but after the lapse of a couple of hours the food is vomited, the vomited matters being very acid, and often bitter from admixture of bile. In severe cases the vomiting has been known to occur after every meal for several months. Flatulence, relieving itself in eructations, is one of the standard symptoms of this affection, the gas that gives rise to this symptom being sometimes evolved from undigested matters in the stomach. It is very apt to occur in dyspeptic patients if they have fasted rather longer than usual. *Cardialgia* (popularly known as *heartburn*), *pyrosis* (q.v.), or water-brash, and *gastrodynia* (commonly designated *spasm* or *cramp* of the stomach, and coming on at uncertain intervals in most severe paroxysms) are somewhat less common symptoms of indigestion.

The treatment of indigestion is more dietetic than medicinal. All bad habits suggested above must be corrected. The quantity of food which can be digested by the gastric juice and intestinal fluids being limited (see DIGESTION, ORGANS OF), care should be taken to avoid excess; moreover, the meals should not succeed each other too rapidly. With regard to the nature of food best suited to dyspeptic persons, it may be safely asserted that a mixture of well-cooked animal and vegetable food is in general more easily digested than either kind taken exclusively. Each patient should be advised by his physician as to his dietary. The unquestionable benefit which dyspeptic patients often derive from a visit to a hydropathic establishment is due perhaps not so much to any specific action of the water as to the well-regulated diet, the withdrawal of the mind from personal cares, and the change of scene. The use of purgatives and remedies for indigestion is much overdone by the laity, and lays the foundations of chronic gastric disorder that cannot be cured.

INDIGIRKA, ĕn'dyē-gēr'kȧ. A river of Eastern Siberia. It rises in the Stanovoi Mountains, 400 miles east of Yakutsk, and, after flowing in a northeasterly course for about 900 miles across a sparsely populated and frozen desert region, it empties through a large delta into the Arctic Ocean, 460 miles east of the mouth of the Lena (Map: Asia, O 1).

INDIGO (Sp. *índigo*, *índico*, from Lat. *indicum*, from Gk. *ἰνδικόν*, *indikon*, indigo, from Ἰνδία, *India*, India). A coloring matter first employed as a dyestuff in India, whence it was brought by traders to the Mediterranean countries. Europeans were not acquainted with its vegetable origin until the time when its importation assumed considerable dimensions, after the circumnavigation of Africa; and as the method of dyeing with woad did not present the indigo in substance, the virtual identity of the two was not suspected. Of late years, artificial indigo has been produced from coal-tar products, and is seriously threatening the existence of the indigo plantations. For the history of artificial indigo, see COAL-TAR COLORS.

INDIGO.

Most of the natural indigo of commerce is obtained from species of Indigofera, of the family Leguminosæ. The genus embraces about 400 species, widely distributed throughout tropical and subtropical regions. The best-known and most widely cultivated species, as well as the ones which supply nearly all the indigo found in the markets, are *Indigofera anil*, a native of tropical America, and *Indigofera tinctoria*, the original home of which is not positively known, although it is said to occur wild in the Bombay Presidency. *Indigofera argentea*, a native of Arabia and parts of Africa, is a source of much of this valuable dye. Indigo plants are extensively cultivated in the East and West Indies (especially in Bengal), in Central America, parts of Europe, and Africa, etc. The plants are shrubby, attaining a height of about six feet, have pinnately compound leaves, and usually pink or purple flowers. The pods of *Indigofera anil* are sickle-shaped, short and compressed, while those of *Indigofera tinctoria* are straight, cylindrical, and many-seeded. When cultivated the indigo plant requires a rich, friable soil, well watered, but not too wet. The seeds are sown in drills about a foot apart, and the plants are cut when beginning to flower. In the tropics this can be done at frequent intervals, and four or five crops a year obtained. After cutting, the crop is handled in various ways, fermented in tanks, as described below, and the indigo extracted. Although the plants are perennial, the greatest yields are obtained from annual plantings. In addition to the species mentioned above, at least half a dozen other species of Indigofera are known to produce indigo of good character. It is also produced by species of Sophora, Baptisia, Amorpha, Tephrosia, and Galega, all belonging to the order Leguminosæ. Baptisia tinctoria and Amorpha fruticosa are known as 'false indigo' in the United States, where they are widely distributed. Plants of other families produce indigo, as Isatis tinctoria, a cruciferous plant which was cultivated in Europe during the Middle Ages and is still planted in Southern France (see WOAD); Wrightia, and Nerium, which belong to the family Apocynaceæ; Marsdenia tinctoria and Gymnema tingens, of the natural order Asclepiadaceæ; Polygonum tinctorium, of the order Polygonaceæ; Strobilanthes flaccidifolius, of the order Acanthaceæ; Spilanthes tinctoria (Compositæ), and Scabiosa succisa (Dipsaceæ), as well as many others, representing widely separated orders of plants.

Neither the indigo plant nor Isatis tinctoria contains the dyestuff (indigotin) ready formed, but rather a colorless glucoside, indicane, which breaks up, by fermentative processes, into indigotin, and a glucose sugar called indiglucin. It is a curious fact that indicane is a normal constituent of human urine, and becomes very plentiful in certain diseases. Natural indigo is prepared for the market in the following fashion: The plants are cut down just before reaching the flowering stage, and are thrown into vats, where they are steeped in water and allowed to ferment for 12 to 15 hours, practically out of contact with air. This produces the soluble *indigo white*, which is taken up by the water; the liquid is then drawn off into 'beating-vats,' where it is violently agitated by machinery, in order to promote contact with the air, so that the indigo white is oxidized to the insoluble *indigo blue*, which forms a thick scum on the surface and then sinks to the bottom as a bluish mud. After settling, the clear liquid is drawn off, and the indigo blue is collected, squeezed between cloths, and dried in the air. It is sold in irregular lumps, which differ in tint, size, and texture according to the various localities in which they are produced. The amount of available dyestuff ranges from 20 to 90 per cent. of the commercial product, some of the impurities being accidental, although intentional adulteration is common enough. This irregularity of composition in the natural product is one of the causes that have advanced the manufacture of artificial indigo, which is always chemically pure. There are a large number of patented processes for the preparation of synthetic indigotin, chiefly held by the German color-factories, and largely based upon the researches of Adolf Baeyer, who showed, about 1880, what the exact chemical constitution of this substance is, and indicated the general principles for its preparation from aniline derivatives. At present, indigo is manufactured on the largest scale by the Heumann process. Phthalic acid, from naphthalene, is converted into anthranilic (ortho-amidobenzoic) acid by way of the phthalimide, and the anthranilic acid is transformed, by treatment with chloracetic acid and fusion with sodium hydroxide, into indoxyl, which readily oxidizes to indigo. According to the United States Census for 1900, three million pounds, or one-quarter of the world's supply of indigo, are annually produced by synthesis. Pure indigotin, whether extracted from natural indigo or prepared artificially, is crystalline, with a coppery lustre and a very characteristic odor; when crushed, it forms a blue powder, and when fixed upon the fibre it constitutes a remarkably fast and brilliant 'navy-blue' dye. A few chemical compounds, analogous to indigo, and of slightly different shades, have been produced; but they are as yet of very slight importance. Mention may also be made of the so-called *indirubin*, a red coloring matter of insignificant tinctorial value, which is found in natural indigo.

DYEING WITH INDIGO. As indigo blue is insoluble in water, it must first be converted into indigo white, which is soluble in alkaline liquids. This change is produced by the chemical addition of hydrogen, so that the blue, $C_{16}H_{10}N_2O_2$, goes over into the white, $C_{16}H_{12}N_2O_2$. This is effected in *cold* vats, which are employed for the dyeing of cotton and linen, by metallic reducing agents, such as sulphate of iron, zinc dust, and alkaline sulphites; while wool and silk are dyed in *warm* vats, where the reduction is caused by a fermentation of vegetable substances, preferably woad, in a manner analogous to that by which indicane is converted into indigo white. These vats are always alkaline. When the reduction of the indigo is completed, the liquid is colorless, with a light bluish scum on top. The scoured materials are then drawn through the vats and exposed to the air while drying. The atmospheric oxygen immediately reconverts the white into the blue, by removing the extra hydrogen atoms. Indigo blue is also soluble in fuming sulphuric acid, forming 'indigo-sulphonic acid' or Saxon blue, which was formerly known as a dyestuff, but has been replaced in modern practice by its sodium salt, *indigo carmine*. The solution of this carmine produces a blue precipitate upon the fibre with an alum mordant, but the color is neither as deep nor as fast as that of the unaltered indigotin from the reducing-vats. With artificial indigo, the final synthesis can be produced on the fibre itself, as when ortho-nitrophenylpropiolic acid and potassium xanthogenate are applied separately and the doubly impregnated cloth is then steamed, whereupon indigo blue is formed within the fibre, and the by-products can be washed out.

PRINTING WITH INDIGO. Indigotin is not suited to printing in pigment form, and figured goods are produced by what may be considered as dyeing processes. To procure a blue-and-white pattern, for instance, the whole fabric may first be dyed blue, and the white produced by printing on bleaching agents which will remove the color.

Or the cloth may first be printed with a 'reserve,' a paste composed of gum, pipe-clay, and copper salts, which will prevent the deposit of indigo upon the spots which they protect, while the material passes through the vat. Artificial indigo can again be produced by printing one chemical upon the fibre and putting the other into the bath through which it is subsequently passed.

BIBLIOGRAPHY. Benedikt, *Chemistry of the Coal-Tar Colors* (London, 1889); Nietzki, *Chemistry of Organic Dyestuffs* (London, 1892); Sadtler, *Handbook of Industrial Organic Chemistry* (Philadelphia, 1895). Consult also Baeyer's articles in the *Berichte der deutschen chemischen Gesellschaft* (Berlin) for 1879-90, and Lachmann in the *Journal of the American Chemical Society* (Easton, Pa.) for 1901.

INDIGO-BIRD. A North American finch (*Passerina cyanea*) of the Eastern United States. It breeds as far north as Nova Scotia and Minnesota, but migrates southward in the fall to Central America, where it spends the winter. It is about 5½ inches in length, and the adult male is rich dark blue in color, variously tinged and shaded, the lores and angles of the chin velvety black. The female is gray brown. It frequents open places on the edges of woods, and delights to sit on the top of a high tree singing a very sweet and peculiar melody, continued late into summer, after most other birds have stopped singing. It is easily domesticated. The nest is built of grasses, leaves, bark, and long hairs, in a little bush or on weeds near the ground. The eggs are three or four, pale bluish white, without spots. See Colored Plate of EGGS OF SONG-BIRDS.

INDIGO-SNAKE. See GOPHER-SNAKE.

IN'DIUM (Neo-Lat., from Lat. *indicum*, indigo). A metallic element, discovered by Reich and Richter in 1863. It occurs in minute quantities in various zinc ores, especially in the zinc blendes of Freiberg, in some galenas from Italy, and in the flue dust of zinc-furnaces. In the metallic state, the element may be obtained by reducing its oxide in a current of hydrogen, or by fusing the oxide with sodium. The oxide itself is obtained by dissolving Freiberg zinc in weak sulphuric acid, precipitating the solution with metallic zinc, and separating out, from the precipitate, lead, copper, and iron. With oxygen indium forms two compounds, a monoxide (InO) and a sesquioxide (In_2O_3). A number of its salts have been prepared, but none of them has any economic value. Metallic indium is ductile, silver-white, and lustrous. Its specific gravity is from 7.36 to 7.42 and its melting-point is at 176° C. Its chemical symbol is In, and its atomic weight, referred to oxygen, is 114.

INDIVIDUALISM (from *individual*, from ML. *individualis*, relating to an individual, from Lat. *individuus*, indivisible, from *in-*, not + *dividuus*, divisible, from *dividere*, to divide). The doctrine that society is only an artificial device, whose value is to be gauged by its conduciveness to the good of the several associated members or by some other standard set by these individuals. Individualism must be distinguished from egoism, with which it is often confounded. While individualism perhaps is generally egoistic in character, it is not always so. An individualist may maintain that the end which justifies all justifiable means is "the greatest good of the greatest number;" what makes him an individualist is his conception of the greatest number as composed of *independent* units, the happiness of each of which is to be reckoned as *a separate item* in the sum total of general happiness. Such being the nature of individualism, it is clear that in all the sciences which deal with man as a social being there may be individualistic tendencies. And as a matter of fact individualism has been a marked characteristic of many prominent theories in political science, in economics, and in ethics.

In political theory the consistent individualist regards the State as a means to subserve individual ends. He may be an egoistic anarchist, desiring to remove all restraints which the State imposes upon his freedom of action. On the other hand, he may be an absolutist, believing that the restraints imposed by a supreme government are necessary to prevent the disastrous consequences which would follow from every man's acting upon his unregulated desires, and thus involving himself in perpetual warfare with all his neighbors. Thus we see that the sovereignty of government, which the individualist must deny in ultimate theory, he may stoutly maintain in practical politics. Hobbes, the prime individualist of modern times, was nevertheless one of the stanchest supporters of unlimited despotism when despotism was making its last stand against parliamentary government in England. Again, an altruistic individualist may, like the egoistic, be either an anarchist or a believer in government. The anarchism of our day is in large measure a reaction against absolutism, a reaction motived by a sincere desire to secure for mankind at large the blessings of freedom. The trouble with it is that it conceives freedom as license, and regards license as in its nature humane when not irritated by authority. Other altruistic individualists, however, who do not share with the benevolent anarchist the optimist belief that man is by nature a saint and only by government a sinner, justify government as a necessary evil: an evil because individuality is more or less repressed by law, but a necessity because without some measure of such repression some individuals would make life intolerable or even impossible for others. It is thus clear that individualism as a political theory is quite compatible with acquiescence in and support of almost any form of government, or even with revolt from all government. Practical individualism, on the other hand, may prevail to a large extent along with anti-individualistic theories, for it is quite logically consistent for a thinker to maintain that the true end of all government is the welfare of society as an organic whole, and yet that this welfare can best be served by allowing every individual to pursue his own ends.

In economics individualism has generally advocated the practice which is formulated in the well-known precept, *laissez faire, laissez passer*. The State is to keep hands off of the economic machinery. Free competition, resulting in the survival of the economically fittest, is the individualistic ideal. Hence we find among individualists a tendency to oppose all sumptuary and other economic legislation. Compensation for service rendered is held to be a matter which concerns merely the parties immediately involved, and no general laws, it is urged, should control the unrestricted privilege of any man to buy labor as cheap and to sell it as dear as the relation between supply and demand allows. No minimum of wage, no maximum of hours, no restriction upon the age or sex of employees, no employer's liability except as specified by contract, no fostering of industries by tariff or subsidy, no political arbitration of economic disputes, no Government ownership or operation of any industrial plant—in short, no State interference in production, distribution, or consumption—this is what absolute and unadulterated individualism is apt to hold before itself as the true type of the industrial life. But pure economic individualism is at the present day more a theory than a practice. Public policy has asserted itself against private license, and the struggle at present is not so much between State interference and free competition as between different views as to the points at which State interference is advisable. Thus, in the United States both of the great political parties are anti-individualistic in their economic principles. The Republican Party stands for State interference in international trade, while in matters of internal policy it is inclined to allow competition a freer hand. The Democratic Party advocates greater freedom in international economic activity, while, at least of recent years, it has sought to interfere with the freedom of capital to combine and with the freedom of natural preference for the economically more valuable medium of exchange found in gold. The paternalism of the tariff is offset by the paternalism of State-ordained bimetallism. Individualism has become more of a war-cry than an accurate designation of economic principle. What is true of American economics is also true of the economic status in other civilized countries. The socialism and the agrarianism of Germany are no more and no less anti-individualistic than the governmental policy they oppose. The question is only as to the character of the limitations to be put upon the freedom of the individual in his economic relations.

In ethical theory individualism is not now so important a factor as it was a century or so ago. Pure individualism is incompatible with morality as ordinarily understood. If each man's ideals are the measure of his morality, morality ceases to have any general meaning. This is frankly recognized by some individualists; but some, on the other hand, still maintain the possibility of carrying their theory out logically without detriment to morality. The typical representatives of the latter view are to be found among those who claim for the individual conscience the right to pass definitively upon all questions of morals. "There is no such thing as an erring conscience," they say. In some thinkers, as, for example, Kant, the individualism of the conscience theory of morals is offset by the universalism of the criterion of reason, which directs the conscience. One must see one's duty only in what can be duty for all. The combination of individualism and anti-individualism in an ethics of conscience is, however, a *tour de force* which can be successfully achieved only by those who unknowingly have a higher standard for morality than either conscience or pure reason. But when this higher standard is lacking, individualism gets the upper hand, and we have as the logical result the view that everything is right which a man thinks to be right. The individual with all his idiosyncrasies becomes the measure of the universe. Most ethical thinkers have come to see that this is the natural consequence of the contention that conscience is the supreme *arbiter morum*, while moral practice has always been controlled by other influences besides the conscience of the individual. Or perhaps it would be more correct to say that these other influences operate upon a man by giving character and direction to his conscience, so that while he is guided by his conscience, that conscience is not merely an individual peculiarity. It reflects with greater or less accuracy the ideals of his community—a community sometimes large, sometimes small, but, whether large or small, of decisive influence in determining the kind of conscience the man is to have. Hence, as conscience is not something ultimate and intuitive, but derivative, there is no reason for supposing that its dictates are incorrect. The individual reflects the opinions, prejudices, superstitions, and sane judgments of a community, and gives to them perhaps an individual coloring, especially in matters bearing on his own conduct. The result we call conscience.

The history of individualism cannot here be given. All that can be done is to refer to other articles in this Encyclopædia treating of persons who have made that history. See SOPHISTS; GROTIUS; HOBBES; LOCKE; SPINOZA; QUESNAY; MIRABEAU; TURGOT; SMITH, ADAM; BENTHAM; BRIGHT, JOHN; MARX; SPENCER, HERBERT; NIETZSCHE. Consult, also: Donisthorpe, *Individualism, a System of Politics* (London, 1889); Le Gall, *La doctrine individualiste et l'anarchie* (Toulouse, 1894); McKechnie, *The State and the Individual* (Glasgow, 1896); Ritchie, *The Principles of State Interference* (London, 1891); Schmidt (Max Stiner), *Der Einzige und sein Eigenthum* (Leipzig, 1845); Spencer, *Man versus the State* (London, 1884); Wenzel, *Gemeinschaft und Persönlichkeit* (Berlin, 1899); Lutoslawski, *Ueber die Grundvoraussetzungen und Consequenzen der individualistischen Weltanschauung* (Helsingfors, 1898); Tufts and Thompson, *The Individual and His Relation to Society, as Reflected in British Ethics* (Chicago, 1898).

INDIVIDUALITY (from ML. *individualitas*, from *individualis*, relating to an individual). Separate or distinct existence. There is some difference of opinion as to what constitutes individuality, the discussion being principally confined to the domain of natural history. Some authorities regard the various organisms springing by buds from a single hydroid as individual. Others consider various parts of a tree to be individuals. In one sense all the organisms proceeding from one egg may be considered as constituting one individual, since they are derived from one germ, and the production of the zoöids by budding is similar to the development of a stock by grafting; but similar only because, in grafting a part of one individual, and not a germinal part, is inserted into another, and there proceeds to grow, as if the original plant extended itself. But in the budding of hydroids the different zoöids produced exactly resemble each other, depart from each other, and develop independently into hydroids like their parent; and some may develop much more rapidly than others. The production of a zoöid is more like original germination or ovum development than the growth and extension of a part of the common tissues of a parent.

Individuality, in the psychological sense, which is different from the preceding biological and physiological meanings of the term, has reference to the personality of experience which is largely constituted by the continuity of the personal memory. Cases have not infrequently been reported where this memory continuum has been broken off and another instituted in its place, as the result of hypnotism or some form of disease. A person thus affected loses all memory of previous bodily existence, together with name, home, family, and friends, and begins a life so entirely new and different that he may be called another and different personality. The greatest number of personalities mutually ignorant of the existence of others connected with the same brain is five, in the case of Louis V., reported by Böurru and Burot in *Variations de la personnalité* (Paris, 1888). For further information, consult: Binet, *Altérations de la personnalité* (Paris, 1892); Janet, *L'automatisme psychologique* (Paris, 1889); James, *Principles of Psychology* (New York, 1890); Podmore, *Studies in Psychical Research* (London, 1899). See DOUBLE CONSCIOUSNESS.

INDIVIDUAL PSYCHOLOGY, or DIFFERENTIAL PSYCHOLOGY. That branch of psychology which deals with the individual differences between mind and mind, as distinct from general psychology (see PSYCHOLOGY), which deals with mental constants and uniformities. It thus includes what Mill called 'ethology' and Bahnsen 'characterology,' though it is as much wider than this discipline as the concept of mind is wider than that of character. Its first principal problem is (1) to determine the range and nature of mental variations. This falls into two part-problems. The individual psychologist must (a) ascertain how and to what extent mental processes vary from one individual to another, and (b) trace the relation of the processes to one another in a single mind, thus discovering whether they are mutually independent, or whether there are certain fundamental processes upon which the rest depend. The answers to these two questions form the contents of differential psychology proper. We have, however, further to inquire (2) into the conditions of the variations which we have established; we must investigate the influences of heredity, climate, position in life, adaptation, education, sex, age, etc. And lastly (3) we must examine, classify, and explain the expressions of mental difference in handwriting, physiognomy, characteristic gesture, literary style, etc.

The first of the three main problems is psychologically the most important. The observed differences between mind and mind have led, in the first place, to the elaboration of a doctrine of psychological *types*, which—seeing that the mind experimented on in the laboratory is always an individual mind—promises to be of value, not only for individual, but also for experimental psychology (q.v.). Practically all the more complex mental functions (ideation, attention, memory, judgment, action, assimilation, constructive ability) evince typical differences. Unless we take account of them we cannot adequately interpret our experimental results. Conversely, it is clear that the careful and exact work of the laboratory is peculiarly adapted to bring out the differences which individual psychology is seeking. More difficult is the second part of the problem: to determine the interrelation of the variable processes within a single mind. Here we have three methods at our disposal. The first is that of abnormal cases; we may take advantage of instances where there is extreme development or enfeeblement (perhaps even loss) of some processes, to study the resulting modification of other processes. We may ask, e.g. how loss of memory affects imagination, attention, power of observation, etc. The second is that of isolated variation; we may, by experimental means, vary a single mental process, and see if this variation involves changes in other processes in the same mind. The third is that of 'tests;' we choose in advance a number of processes for study, and proceed to examine them in a number of individuals, noting whether the individual differences in the selected processes run parallel to one another, and correspond in a regular manner. This correspondence or the lack of it will show the degree of correlation obtaining between the mental functions studied. The method is extremely laborious, but is at present more available than any other, and should, in the long run, lead to valid results. Binet and Henri, e.g. suggest the following tests: (1) Memory: Visual memory of geometrical design, memory of sentences, musical memory, memory of colors and of figures. (2) Nature of mental images. (3) Imagination: Passive (finding forms or faces in ink-blots), constructive (development of an essay theme), of design (composition or completion of a picture), and literary (construction of sentences from given substantives or verbs). (4) Duration and range of attention. (5) Comprehension: Observation (analysis of a machine) and discrimination (definition of synonyms). (6) Suggestibility. (7) Æsthetic and moral sentiments. (8) Muscular force and strength of will (persistence in muscular effort). (9) Motor skill and sureness of eye.

Consult: Stern, *Ueber Psychologie der individuellen Differenzen* (Leipzig, 1900), which contains a bibliography; Kraepelin, *Psychologische Arbeiten* (Leipzig, 1896); Titchener, *Experimental Psychology* (New York, 1901).

INDO-CHINA. A geographical term formerly designating the southeastern peninsula of Asia (Farther India), embracing Burma, Siam, French Indo-China, etc.

INDO-CHINA, FRENCH. See FRENCH INDO-CHINA.

INDO-CHINESE. The name applied as a general term to the great majority of the native population of Farther India, or Indo-China. It originally indicated that these peoples were related by speech and physical characteristics to the Chinese, but in part also somatically and culturally to the peoples of Hindustan. The Indo-Chinese peoples speak what are called 'tonic monosyllabic' languages, forming, with the Tibetan and Chinese groups, the extensive and important Sinitic or Tibeto-Chinese stock or family. The chief Indo-Chinese peoples are the following: Burmese, Siamese, Annamese, Cambodians, Tonkinese, who have all in some respects reached the status of civilization. Related to the Siamese are the other Thai tribes, Shans and Laos, who preserve (some of them, at least) the primitive type of the Thai stock better than the Siamese, and are likewise less civilized, though in the past they have created or have been the bearers of several half-civilizations. The Cambodians, or Khmers, about whose linguistic and somatic relationship there is still some dispute, authorities crediting them with Aryan affinities, especially as to physical characters, have behind them the more or less indigenous culture represented by numerous inscriptions and by the remarkable temples and monuments of Angkor-Vat, etc. The culture of the Indo-Chinese peoples has been largely influenced by both India and China, while the more primitive Malays have also had a not insignificant share in the physical and social complexes there existing. The Khmers have in earlier times borrowed not a little from Hindu sources, though this borrowing may not have been so great as has hitherto been assumed. The Burmese owe a good deal of their civilization to India, the Siamese almost as much, though more indebted to China than the Burmese; while the social life and culture of the Annamese is largely a reflection of Chinese. The Assamese of the northwest, who speak an Aryan language closely related to Hindi, are probably a mixture of some of the more primitive tribes and Hindus. The exact relationship of some of the savage tribes of the northern parts of Farther India is not yet clear, but those not distinctly Thaï are more closely connected with the pre-Sinitic inhabitants of Southern China and the Tibetan area. The Mois, by which general name a number of more or less primitive tribes scattered over the eastern mountains and tablelands are known, are an aboriginal race with perhaps a Caucasian strain. The Kuis of the Shan States are probably aboriginal like the Mois; the Kuis of Cambodia have for some time been rapidly assimilating in speech and otherwise to the Cambodians. The Mons, or Talaing, of Burma, formerly had a much greater extension, but have been driven back by the more civilized peoples and the mixed races of modern origin. The Tchiam or Chiam, who are the modern representatives of the people who founded the ancient Empire of Champa, are by some authorities thought to possess Malay linguistic affinities. The Karens of Burma, who have recently shown themselves to be so amenable to missionary influences, are related to the Burmese linguistically and physically, but are of a more primitive type. The numerous Chin tribes of the Northwest are probably closely related to the primitive Burmese, but some of them are of very mixed type. The Lushai tribes are perhaps similarly related in general; they, together with the Nagas of the mountains of Manipur, are now more or less mixed—some of them have been thought to have Malay affinities. The Indo-Chinese peoples as a whole are probably of Mongolian stock, with early and later admixtures of Aryans and non-Aryans from India, etc., Malays and possibly Negritos, besides interminglings with the more modern peoples of the Indo-Chinese area. Like Hindustan, Farther India has had a history of primitive occupation, indigenous culture evolutions, foreign conquests, native combinations and disputes, etc. The more civilized peoples have more or less exploited for agricultural, commercial, and labor purposes the less civilized; the Burmese and Siamese the Shans, the Annamese the Mois, the Laos the wilder peoples of their country; and to this general exploitation the Chinese, whose coming into this area as colonists and traders antedates the Christian Era, have added much. Back of the modern civilization of Burma, Siam, Annam, Cambodia, etc., lie older half-civilizations of the more primitive tribes—Khmers, Shans, Laos, etc.—whose remains are of considerable importance and of great antiquity. Back of these again are the monuments of prehistoric man in this part of the world—the kitchen-middens of Cambodia, the stone monuments of the Khasi country, etc., and, earliest of all, the chipped implements discovered by Noetling in 1894 near Yenangyoung, on the Irrawaddy, in Upper Burma, which are claimed to prove the existence of Tertiary man in this region. It is probably from some of the proto-Indo-Chinese or their closely allied predecessors that the Malayan stock has sprung. Some of the Indo-Chinese, however, exhibit closer somatic affinities with certain of the Mongolian natives of Northeastern Asia, such as the Tchuktchi, etc. Consult: Von Hellwald, *Hinterindische Länder und Völker* (Leipzig, 1880); Forbes, *Comparative Grammar of the Languages of Farther India* (London, 1881); Bastian, *Völkerstämme am Brahmaputra* (Berlin, 1883); Ehler, *Im Sattel durch Indo-China* (ib., 1894).

INDO-CHINESE SUBREGION. In zoögraphy, a faunal district of the Oriental Region, comprising all that part of China south of the high mountains which carry the Himalaya range eastward nearly to Fu-chow, and form the watershed between the south coast and the valley of the Yang-tse; also all of Annam, Siam, Yun-nan, Burma, and Assam, and a long, narrow extension westward along the southern slopes of the Himalaya, between the levels of about 2500 and 9000 feet. The name 'Himalayan' or 'Himalo-Chinese' is therefore sometimes given to this fauna and subregion. It is one of the richest faunas in the world, and is especially distinct in its birds, of which more than 40 genera are peculiar, among which the pheasants are conspicuous. In the higher mountains Palearctic forms mingle with it to some extent, but on the whole the affinities are distinctly Oriental. See map under DISTRIBUTION OF ANIMALS.

INDO-EUROPEANS. A term frequently applied to the so-called Aryan race (see ARYAN; EUROPE), as being inhabitants of India and Europe. The word is, however, linguistic rather than ethnological. Even in linguistic usage the term is abandoned by the leading authorities, except among French and Italian scholars, in favor of Indo-Germanic. See INDO-GERMANIC LANGUAGES.

INDO-GERMANIC LANGUAGES, often called INDO-EUROPEAN, ARYAN, or sometimes INDO-CELTIC. The name given to the great cognate group of tongues spoken by the kindred peoples of Southern and Southwestern Asia and Europe, and extending from India as far as the people of Germanic blood have spread. (See ARYAN.) This great group is quite distinct from the Semitic family of languages, from the forms of speech spoken by the Mongolian tribes, and from the various other recognized groups of tongues which are distributed over the world. The question as to the situation of the primitive home of the Indo-Germanic peoples has been much discussed. The present tendency is to locate the original Indo-Germanic habitat in Central or Northern Europe rather than in Asia. Various theories have been advanced, especially a generation ago, to account for the present distribution of these languages. The genetic arrangement of the tongues in a genealogical tree by Schleicher and other scholars, or views as to migratory movements or dissemination, like Johannes Schmidt's 'wave theory,' will be found referred to in most books relating to linguistics and comparative philology. The kinship of these languages has been scientifically proved by the family features and general likeness in their structure. In point of age they go back as far as the literary monuments of the Vedas.

The division of the Indo-Germanic peoples as represented by the various branches of speech is generally considered to be eightfold, as follows: (1) Indo-Iranian or Aryan proper, the ancient and modern languages of India and Persia; (2) Armenian, forming a sort of bridge between Asia and Europe; (3) Grecian or Hellenic, with its modern representatives in the tongues of Northern Greece and the Peloponnesus; (4) Albanian, a more modern representative of the ancient Illyrian; (5) Italic, the Latin, with its modern descendants in the Romance tongues; (6) Celtic or Keltic, originally occupying the west of Europe, but now confined chiefly to the British Isles, and of particular interest to the historical student of English and French philology; (7) Germanic, the important group to which the Anglo-Saxon, English, the German, and other Teutonic tongues belong; and lastly (8), the Balto-Slavic group, the chief representative of which is the modern Russian. The various subdivisions of these language divisions, together with their branches or dialects, will be found under the respective titles. Besides these there are some sporadic traces or representatives of other Indo-Germanic idioms which are not included in the list because the fragments are too scanty or too scattered to allow a determination in detail of the real character of the speech. Such are the Phrygian, which has affinities with the Armenian, or again the Messapian, which may be connected with the Albanian, or still further, the Macedonian, Gallic, Burgundian, or the like.

With reference to the general features, the Indo-Germanic languages are an inflectional group of tongues, sprung from a common ancestor no longer in existence. They have certain marked or distinctive features or variations of sound and accentuation that are more or less common to all, and they show a general similarity in structure as to roots, affixes, composite forms, with kindred variations of nouns, adjectives, pronouns, and verbs through eight cases, three numbers, including a dual, and a variety of moods and tenses, together with certain common phenomena in syntax and word-order. For a full bibliography, reference may be made to the standard work on the subject, Brugmann, *Comparative Grammar of the Indo-Germanic Languages* (5 vols., London, 1888-95), translated from the German without the three volumes on syntax by Delbrück. A second and revised edition of the original German work began to appear at Strassburg in 1897. Consult also the authorities referred to under Aryan; Inflection; Language; Philology; Phonetic Laws; and also the articles on Albanian Language; Armenian Language and Literature; Celtic Languages; Greek Language; Indo-Iranian Languages; Italic Languages; Latin Language; Romance Languages.

INDO-IRANIAN LANGUAGES. A branch or group of the Indo-Germanic family of languages. It comprises the Indo-Germanic languages of ancient and modern India, Ceylon, Persia, Afghanistan, Baluchistan, Kurdistan, and the Ossetic portion of the Caucasus. Although the vowel-system is meagre, the consonants, generally speaking, best represent the pre-Indo-Germanic conditions. In inflection this group is the most primitive and highly developed of all the Indo-Germanic language divisions, while the most ancient literature in Indo-Germanic is preserved in Indo-Iranian. See Afghan; Avesta; Baluchi; Bengali Language and Literature; Ceylon, section Language and Literature; Gujarati Language and Literature; Hindustani Language and Literature; Indian Languages; Indo-Germanic Languages; Kashmiri; Kurdish; Maldive Language; Marathi Language and Literature; Naipali; Old Persian Language; Ossetic Language; Pali Language and Literature; Pahlavi Language and Literature; Panjabi Language and Literature; Persian Language; Prakrit Language and Literature; Sanskrit Language; Uriya Language and Literature.

INDO-MALAYAN SUBREGION. See Malayan Subregion; Indian Subregion.

INDONESIAN, ĭn'dô-nē'zhan (from Gk. Ἰνδός, *Indos*, Indian + νῆσος, *nēsos*, island). A term, coined in analogy with Polynesian, Melanesian, Micronesian, etc., used by certain ethnologists to denote certain peoples of the East Indies and Polynesia who are neither Malays nor Papuans, but Caucasian in type. Such authorities would include under this head the 'Eastern Polynesians,' certain tribes of Sumatra, Java, Borneo, the Philippines, etc. The differences between the so-called 'Indonesians' and the Malayan stock are, however, neither so important nor so significant as these writers claim, and there is good reason for looking upon the former as only a more primitive Malayan type, or proto-Malays. The 'Indonesians' and Malays are probably closely related, the former being really primitive Malays. The term 'Indonesian' was introduced by Logan, who attributed a Caucasian (Indian) origin to the lighter-colored natives of some parts of the East Indies, and extended in meaning by Hamy and others, who enlarged upon this theory. The term 'Indonesia' is used by some authorities to designate the Malay Archipelago, or island-group of the East Indies.

INDOOR BASEBALL. This sport varies but little from the regular game of baseball (q.v.). It originated at Chicago in 1887, and is credited to George W. Hancock and fellow-members of the Farragut Club of that city. It can be played in any hall of size which will permit of sufficient light and room for the diamond and fielding, the minimum playing floor measuring 40 × 50 feet. The rules are designed to equalize the difference of size and surroundings from outdoor baseball, as are also the implements of the game. The ball is of compact substance, 17 inches in circumference, weighs 8¼ ounces, and has a white cover; the bat being 2¾ feet long and 1½ inches in diameter. The bases are half-filled with sand, or other heavy substance sufficient to anchor them in place, and the rules of the National Indoor Baseball Association of the United States govern the game.

INDORE, in-dōr′. A native Mahratta State of Central India (Map: India, C 4). It is traversed from east to west by the Nerbudda River, and also by the Vindhya Mountains, their loftiest point within its limits being 2500 feet above the sea. Valuable timber is found in the forest; and wheat, rice, tobacco, sugar-cane, cotton, poppy, etc., are cultivated. Opium is one of the chief manufactures. The Bhils, one of the wildest and most savage of the aboriginal tribes of India, inhabit Indore. Besides the capital of the same name (q.v.), the principal towns are Rampura, Mehadpur, Bhanpura, and Mhow. Area, 8400 square miles; population, in 1891, 372,800; in 1901, 333,000. The Mahratta ruler bears the name of Holkar (q.v.), whence the State is sometimes called the Holkar's Dominions.

INDORE. The capital of the native Mahratta State of the same name, India, situated on the left bank of the Kuthi (Map: India, C 4). It is about 2000 feet above the level of the sea. Indore was founded in 1767, and contains the palace of the Holkar, a college, and mint. It has a modern drainage system, and a good water-supply, and maintains a public lighting plant, market, reading-room, and dispensary. It has manufactures of cotton and a considerable grain trade. A suburban district, assigned by treaty, contains a British residency, the seat of an agent and his staff, and the Government opium depot of the Central Provinces. Population, in 1891, 92,300; in 1901, 86,200.

INDORSED, or **ENDORSED.** See HERALDRY.

INDORSEMENT (from ML. *indorsare*, to indorse, from Lat. *in*, in + *dorsum*, back). In its broadest sense, any writing on the back of an instrument. As a technical term of the law merchant, it denotes the writing of the holder's name upon a bill of exchange, check, promissory note, or other negotiable instrument, on transferring it to another. While this writing is ordinarily on the back of such an instrument (whence its name), it is equally effective if made on its face, or on a paper annexed to the instrument. In order to convert the writing into a contract, it must be delivered with the intention of giving effect thereto; or it must find its way into the hands of a bona-fide holder. The contract obligation of an indorser is to pay the indorsed instrument, provided payment is duly demanded, and payment is refused, and due notice of the dishonor is given to him. If the payee or holder simply signs his name, the indorsement is said to be blank, and the subsequent holder may fill out the indorsement to any one. A special indorsement is one which specifies the person to whom, or to whose order, the instrument is to be payable, e.g. 'Pay C. D. or order. (Signed) A. B.' When personal liability as indorser is to be avoided, the words 'without recourse' are added. Such an indorsement does not prevent the further negotiation of the instrument, or cast any suspicion upon its validity. A similar restriction is made in England in the case of checks by crossing them. (See CHECK.) One which limits further negotiation is called a restrictive indorsement, e.g. 'Pay Corn Exchange Bank only.' It is provided by modern legislation that when an indorsement is conditional, a party required to pay the instrument may disregard the condition and make payment to the indorsee or his transferee, whether the condition has been fulfilled or not. This changes the old rule, under which an acceptor or maker paid a bill or note with such an indorsement at his peril, if the condition was not fulfilled. That was thought to be unduly hard upon the party required to pay. See BILL OF EXCHANGE; CHECK; NEGOTIABLE INSTRUMENT.

IN′DRA. The great national god of Vedic India. Although Indra lost his supremacy through the rise of Brahma, Siva, and Vishnu, he is still preserved as a figure in the Hindu pantheon. As represented in the *Veda* (q.v.), he is primarily the god of the lightning and thunder, with the attendant phenomena of the storm, wind, and rain; by vanquishing the demons of drought and darkness he restores the sun to the sky, the light of dawn, and the day. The realm of his activity is the atmosphere; and the many hymns of the *Rig-Veda* that are devoted to his praise—far outnumbering those to any other god—are rich in meteorological imagery and poetic allusions to natural phenomena. Armed with the thunderbolt (*vajra*), his special weapon, and inspired by copious draughts of intoxicating *soma*, his favorite beverage, he goes forth to do battle with the demons, especially Vritra, who, wrapped like a choking serpent about the clouds, has shut up the waters as prisoners. One of the hymns that describes this battle and the god's triumph over the dragon (*Rig-Veda* 1.32) is an epic in miniature. As the god of battles, Indra is looked upon in the historical hymns of the *Veda* as the royal patron of the victorious Aryans in their conflicts with the aboriginal inhabitants of India. His supremacy during the whole Vedic period is unquestioned; the more ethical and transcendental Varuna is no rival to his prowess.

In the later mythology a change takes place; Indra gradually sinks to a secondary rank among the gods. His installation as god of the lesser divinities is described in the *Aitarēya-Brāhmaṇa;* and from that time onward he becomes rather a figurehead in the pantheon, and the type of a mortal king, than the former supreme lord of heaven. The Epic and Puranic periods distinctly show that he has ceased to enjoy the worship accorded him in Vedic times. He remains ruler of the atmosphere, it is true, and one of the eight world-guardians, regent of the eastern quarter of the sky, wielding his thunderbolt and sending down rain, but his real power is gone. Instead of descriptions of him as the great god of battles, praises are lavished on the delights of his paradise, *Svarga*, with its heavenly musicians and enchanting nymphs, the *Gandharvas* and *Apsarasas*, and all the joys of this happy abode of the gods and faithful worshipers. Like the later writings, the epics bring to view the sensual side of Indra's character in his amours with Ahalya, the wife of a sage — a bit of scandal as old as the Brahmanas. In consequence of the curses of the outraged seer, the god was doomed to lose his virile power; the conqueror Indra ceases to be invincible, even a son of the demon Ravana vanquishes him, as told in the *Rāmayaṇa*, and wins the title *Indra-jit*, victor over Indra, for his prowess. The *Purāṇas* likewise describe him as worsted by the rising god Krishna, an incarnation of Vishnu, and they name various successors of Indra as rulers in the different *manvantaras*, or ages of the world.

Among the Hindus at present Indra is little worshiped. In Bengal a single day of the year is consecrated to his service, and, on occasions of drought, he is prayed to in other parts of the country. But Indra the mighty is no more. His golden chariot in the *Veda* is now replaced by an elephant on which he is generally represented as riding, and the thunderbolt is grasped in his hand. The face and body are sometimes portrayed as covered with figures resembling eyes, into which they are said to have been mercifully transformed from the thousand vile marks that came out upon his person in consequence of the curse brought upon him for his incontinency with Ahalya. For a full description of Indra during the Vedic period, consult: Perry, "Indra in the *Rig-Veda*," in the *Journal of the American Oriental Society*, vol. xi. (New Haven, 1880), and Macdonell, *Vedic Mythology* (Strassburg, 1897); for the later Indra, consult also Dowson, *Hindu Mythology* (London, 1879); Hopkins, *Religions of India* (Boston, 1895); Wilson, *Hindu Mythology* (2d ed., London, 1900).

INDRANI, ĭn-drä'nē. A name of the wife of the Hindu god Indra (q.v.) in the *Veda*. She is called Saci or Andri in the later legends.

INDRE, äN'dr'. A river of France, rising on the northern border of the Department of Creuse (Map: France, H 5). It flows northwest through the departments of Indre and Indre-et-Loire, past the towns of La Châtre, Châteauroux, and Loches, and joins the Loire 17 miles below Tours, after a course of 136 miles, for the last 40 of which it is navigable for small craft.

INDRE. A central department of France, the western portion of the old Province of Berry, lying immediately south of the Department of Loire-et-Cher. Area, 2666 square miles, of which about four-fifths are in tillage and pasture (Map: France, H 5). Population, in 1896, 289,206; in 1901, 288,788. The chief rivers are the Indre, the Vienne, the Creuse, and its tributary, the Anglin. The surface is for the most part flat, and the land is generally fertile, producing large crops of wheat and barley. The principal resources of the department are its vineyards and its flocks. The principal manufactures are woolen and linen cloths, hosiery, scythes, paper, and porcelain. Iron-mines are worked. Capital, Châteauroux.

INDRE-ET-LOIRE, ä lwär. An inland department of France, part of the ancient Province of Touraine, lying northwest of the Department of Indre (Map: France, G 4). Area, 2377 square miles, of which more than one-half is arable; population, in 1896, 337,064; in 1901, 335,541. The department is watered by the Loire, the chief river, and by its tributaries, the Cher, the Indre, and the Vienne, all of them navigable. In the south the surface is hilly, but in the other districts it is undulating and fertile. Cereals are grown, but wine is the most important product. The chief manufactures are bar iron, woolen cloth, silk, rope, paper, and leather. Capital, Tours.

INDRI. A large, monkey-like lemur (*Indris brevicaudata*), of Madagascar, which is regarded as the most highly organized of the tribe, and differs from other lemurs in several important particulars, such as having only 30 teeth, the large size of the hind limbs as compared with the fore limbs, the webbing of the toes, and the fact that only one offspring is produced annually. The coat is variable black and white curiously contrasted, and the ears look like hairy tufts. Unlike most lemurs, the indris are wholly diurnal, going about in the forests of the East Coast, to which they are confined, in small parties, and subsisting mainly on fruit. Their voices are loud, and when angry or hurt the animals utter piercing shrieks or mournful cries. These howlings and other characteristics have led to many native superstitions in regard to the indri, which alone constitutes a subfamily of the Lemuridæ. See Plate of LEMURS.

INDUCED ELECTRIC CURRENTS. See ELECTRICITY; INDUCTION.

INDUCTANCE. See INDUCTION.

INDUCTION (Lat. *inductio*, inference, from *inducere*, to lead in, from *in*, in + *ducere*, to lead). A form of the logical process of discovering the general character of individual phenomena. In order to understand any fact or event, we need not only to be able to tell of its sensible qualities or constituents, but also to know what identity (q.v.) it has with other facts or events. Such an identity is a general character, or, as it is called in logic, a universal. When in the case of several objects we discover an identity in color or shape, we perform the act of conception. If, using some already discovered identity between some objects as a point of departure, we assume some other identity to exist between the same objects, we are said to generalize or to make an induction. Induction may thus be defined as the universalizing of perceived relations or connections between objects. Among these relations one of the most important is that of antecedence and consequence. (See CAUSALITY.) This universalization is corrected or confirmed by further observation of these connections in other individual cases until at last often a valid judgment asserting unconditional connection is reached. A valid induction is one which, starting from particular observations, thus reaches a valid universal judgment. Scientific inductions do not differ in principle from the naïve inductions we have already described; the difference is one of degree, not of kind.

Looking now at inductions ascertained to be valid, we discover three stages in the process of arriving at certified results. The first stage is called *preliminary observation*. At this point actual coexistences and sequences or other relations are observed and form the data for the induction. The second stage consists in the generalization of some actually ascertained coexistence or sequence, or other relations. This is *induction* proper. The third stage is *verification*, the correcting or confirming of the validity of the generalization by further observation. Frequently the term induction is used to include all these three steps; in this case the second step is called generalization. Let us now take up these three steps in order.

I. Preliminary observation may be quite casual and accidental, or it may be intentional. A person may happen to see some connection between phenomena, or he may be intently looking for connections. In the latter case, the observer may simply look at things as they offer themselves to his notice, or he may set about to interfere with the spontaneous course of events in order that he may the better observe the connection. The latter sort of observation is called an experiment. When experiment is possible, it is usually of great assistance in collecting data for generalization. Indeed, almost all the great advances in modern science have been due to experimentation rather than to mere observation. In intentional observation, whether it be simple or experimental, it is extremely important for the observer to know what he is to look for. Not every detail in the complex of details under observation is pertinent to the matter in hand; and yet no *a priori* rules can be given to direct an investigator. Much depends on experience and skill not subject to rules. But by analyzing successfully conducted inductions, logicians are able to formulate several important rules of procedure, which thus are *a posteriori*. For our present purposes we can do no better than quote John Stuart Mill's canons of induction. These state the conditions under which generalization may be made. Hence the observer should be on the watch for the occurrence of these conditions.

The canons are as follows: First Canon, for the Method of Agreement: *If two or more instances of the phenomenon under investigation have only one circumstance in common, the circumstance in which alone all the instances agree, is the cause (or effect) of the given phenomenon.* Second Canon, for the Method of Difference: *If an instance in which the phenomenon under investigation occurs, and an instance in which it does not occur, have every circumstance in common save one, that one occurring only in the former, the circumstance in which alone the two instances differ, is the effect, or the cause, or an indispensable part of the cause, of the phenomenon.* Third Canon, for the Joint Method of Agreement and Difference: *If two or more instances in which the phenomenon occurs have only one circumstance in common, while two or more instances in which it does not occur have nothing in common save the absence of that circumstance; the circumstance in which alone the two sets of instances differ, is the effect, or the cause, or an indispensable part of the cause, of the phenomenon.* Fourth Canon, for the Method of Residues: *Subduct from any phenomenon such part as is known by previous inductions to be the effect of certain antecedents, and the residue of the phenomenon is the effect of the remaining antecedents.* Fifth Canon, for the Method of Concomitant Variations: *Whatever phenomenon varies in any manner wherever another phenomenon varies in some particular manner, is either a cause or an effect of that phenomenon, or is connected with it through some fact of causation.* These are statements of the conditions under which scientific men make inductive inferences. Hence in our observations for the purposes of induction we should keep the following questions in mind: Is it the case that any instance in which the phenomenon under investigation occurs, and any instance in which it does not occur, have every circumstance in common save one? Is it the case that two or more instances of the phenomenon under investigation have only one circumstance in common? Is it true that two or more instances in which the phenomenon under investigation occurs have only one circumstance in common, while two or more instances in which it does not occur have nothing in common save the absence of that circumstance? Is a part of this phenomenon under investigation known to be the effect of certain causes? Does the phenomenon under investigation vary in any manner whatever whenever some particular circumstance varies in some particular manner? In case any of these questions can be answered in the affirmative, an induction may be made. It must not, however, be supposed that an investigator sets about his work with only such general clews as are furnished by these questions. In any particular investigation, a knowledge of exactly what has already been done by previous workers is indispensable. If he has this knowledge, the investigator is in a position to ask much more definite concrete questions than the five we have just mentioned. But, however much more definite his problem may be, it may always be reduced to general expression, and when so reduced it will assume the form of one of the five questions stated above, which give the headings for the treatment of the methodology of observation. Any more specific methodology can be worked out only on the basis of the practiced experience of the expert in any particular line of research.

II. It has already been said that when any one of the five questions given in the last paragraph can be answered in the affirmative, we universalize the actually observed relation between phenomenon and circumstance. But now it will probably be asked what warrant there is for this universalization. The answer is somewhat as follows: To universalize is an instinctive tendency of thought. The child 'jumps at conclusions' in very much the same way as the kitten jumps at a moving string. What the child does, the ordinary adult also does, and unless corrected by experience the probability is that every one would generalize every observed relation. But experience does check the tendency in a measure. The child who generalizes the observed connection between shape and reboundingness, or color and reboundingness, comes by later experience to find that his generalization is invalid. The truth of the universal judgment implied in his expectation is not borne out by later developments. But he is nothing daunted. He proceeds to generalize some other observed connection until at last he gets *a general law which is uncontradicted by experience*, and which he therefore accepts as true. The first generalizations are naïve, instinctive attempts to find uniformity in the world of experience. The attempt in any particular direction may be baffled, but only to be followed by an attempt in another direction. In other words, some attempts fail and others succeed. To succeed is to find that subsequent experience conforms and continues to conform to the expectation aroused by previous experiences. To fail is to find that subsequent experience disappoints this expectation, while in either case the expectation is, from the point of view of logic, an unreflective generalization. In later life consciousness becomes reflective; it looks back upon its own processes and finds that in cases of successful generalization certain conditions are present, while in cases of failure these conditions are absent. The same instinctive generalizing tendency which led to the generalization of the earliest connections discovered, now leads to the generalization of the connections between successful generalization itself and the conditions under which the success is achieved. These latter generalized connections are logical laws of thought. We now are in a position to see that there are two kinds of laws of thought, logical laws and psychological laws. The psychological laws are those which express the modes of thought-behavior, whether the results of the behavior be intellectually satisfactory or not. The logical laws express the conditions under which the results of thought-behavior are intellectually satisfactory to the thinker. Thus it is a psychological law that an immature thinking consciousness generalizes instinctively, i.e. without any foresight of the results to be gained; it is a logical law that if the generalization is to be valid it must be made only under certain conditions, given in the five canons mentioned above. This logical law is itself validated by the fact that it is a generalization made in conformity with the law of which it is itself the expression. In other words, it is self-consistent, and also consistent with all the known facts. A more stringent test of the validity of any law has never been conceived. If now it is further asked whether we know that the thought which conforms to the laws of thought thus discovered will continue to be successful in the future as it has been in the past, we can answer by saying that we have only one plausible reason to suppose it should not be successful, while every other reason that we know would lead us to believe that it will be successful. That one exception is the fact that in past experience when we thought that we had discovered laws, we often found that we were in error. Hence, it may be reasoned, it is possible that we may be in error now as to the logical laws of thought. But this argument has not the force that at first sight we might be tempted to ascribe to it. If we know that in the past we thought wrongly in many instances in which we thought that we were right, and if we now generalize this knowledge and say that therefore on the same principle we may now be in error, and may always be in error, we are making a naïve, uncriticised induction; and such inductions our past experience has proved to us to be very precarious. We can criticise the naïve induction when we discover that in the past any supposed knowledge turned out to be error only in cases which did not conform to certain conditions. If now our generalization as to the valid laws of thought is made in conformity with these conditions, lack of conformity to which made other inductions invalid, then the invalidity of those other inductions is no reason for attributing invalidity to these laws of thought. Past errors in induction should indeed make us very circumspect. We should use our utmost endeavors to avoid the causes which misled us; but having avoided the causes, we need not be timid as to the validity of an induction which in the past has never been impeached by experience, but, on the contrary, has been verified time and time again. A persistent objector may still argue that the fact of our having made errors in the past is still a good reason for doubting the validity of all inductions, and therefore for doubting the validity of the laws of thought which we have discovered by induction. A man who argues thus forces us to resort to a valid form of the *argumentum ad hominem*. (See ARGUMENT.) He obliges us to remark that he assumes for the purposes of his argument the validity of the law he is assailing. What is an appeal to the fact of past error in proof of the fallibility of all laws of thought? It is nothing but an *induction* from past experience. The correctness of the conclusion of this induction would carry with it the invalidity of all argument by induction, and therefore the invalidity of this argument which seeks to prove by induction the correctness of the conclusion. Here as elsewhere (see KNOWLEDGE, THEORY OF) we see that one cannot reason against the laws of reason without putting one's self out of court.

III. Verification of an induction consists in testing it in new instances. Any newly made induction is presumably based on a limited experience and it needs to be examined in its bearings upon other parts of experience. The question in the mind of a person verifying an induction is this: Does the universalized relation prove its universal character in all our experience so far as this experience is pertinent to the relation at issue? This question can be answered only by looking at our past experience and by getting further pertinent experience. No verification of a true universal can be exhaustively completed; but, as we saw under II. above, it may be practically conclusive. There may be no reason left for doubting a proposition except the bare possibility that it may not be true in cases as yet beyond our ken, but a bare possibility is always an unreasonable possibility. The relation of induction to deduction is treated under DEDUCTION. The question whether any general proposition can be arrived at without induction has often been affirmatively answered. (See A PRIORI.) But that answer is incorrect. (See KNOWLEDGE, THEORY OF.) For instance, the geometrical axiom that things equal to the same thing are equal to each other is derived from experience by induction. It is first seen in individual instances that individual things, equal to the same individual thing, are equal to each other. This relation is then universalized. So with the arithmetical judgment: 'Two and two are four.' Hegel and J. S. Mill are the great logical protagonists of this view. Mill's statement of the view is more familiar than Hegel's, but it is defective in that it is based on an atomistic view of experience (see ATOMISM), a view which makes against the validity of induction by reducing all induction to mere simple enumeration (*inductio per enumerationem simplicem*), or a bare telling off of isolated findings, and a summation of the results of these findings into a collective statement.

Consult the authorities referred to under LOGIC; especially to be named here are the logics of Hegel, J. S. Mill, Bain, Minto, Jevons, Ueberweg, Lotze, Wundt, Sigwart, Bradley, Bosanquet, Hibben, and Creighton, also Hobhouse's *Theory of Knowledge* (London, 1896).

INDUCTION. If an electrified body is brought near an uncharged one—either conductor or non-conductor—the latter will exhibit electrical forces; it is said to be charged by 'induction.' In general, if a charged body is surrounded by a uniform medium, such as air, and if a body of any other material than that of the medium is introduced, thus making the surrounding medium heterogeneous, there will be induced charges on the body introduced. The question as to the character of the charges on this body and their distribution depends upon the relative electrical inductivity of the body and the surrounding medium. (See ELECTRICITY.) Similarly, if there is a magnet surrounded by a uniform medium, such as air, and if a body of a different kind of material from the medium is brought near the magnet, it will exhibit magnetic forces and is said to be magnetized by induction. The character and distribution of this induced magnetization depend upon the relative magnetic inductivity of the medium and the foreign body. (See MAGNETISM.) If the body which is introduced is iron or any magnetic body, and if the medium is air, the induced magnetization is such as to produce attraction by the magnet; if bismuth is introduced there will be repulsion. Electromagnetic induction is the phenomenon observed when the magnetic field of force included by a conducting circuit is altered in any way, viz. electric currents are produced in this circuit. These induced currents are due to the *changing* of the field of magnetic force, and are in such a direction as to tend to neutralize the change; they last only so long as the field is changing. See ELECTRICITY.

TUBES OF ELECTRIC INDUCTION are tubes which can be imagined drawn in the medium surrounding electrified bodies by choosing any small closed curve in this medium and drawing lines of force through each point of it. A hollow tube is thus made which has one open end on a positively charged body and the other on one negatively charged. If this tube is made of such a cross-section that it includes unit electrostatic charges as its two ends, it forms a 'Faraday tube.'

TUBES OF MAGNETIC INDUCTION are tubes formed in the same manner in the field around magnets by drawing lines of magnetic force through the points of any small closed curve. Faraday conceived the idea of these tubes being continuous through magnets and all bodies, not ending on any surface; they form, therefore, closed circuits, like a rubber tube with the two open ends brought together. The tubes are conceived to be of such cross-sections that the number leaving a north pole of unit strength is 4π, where $\pi = 3.1416$. See MAGNETISM.

Owing to an electric current in a closed circuit, there is a magnetic field of force inclosing it; the tubes of magnetic induction form closed curves around the conductor. The *coefficient of self-induction*, or the *inductance*, is the number of these tubes threading through the circuit when there is a unit current in the conductor. Some of these tubes of magnetic induction may also in their paths pass through a neighboring closed conducting circuit, and the number of those tubes which do so when there is a unit current in the first circuit is called the *coefficient of mutual induction* of the two circuits. It may be shown that if there is a unit current in the second circuit, thus producing tubes of magnetic induction of its own, the number of these which thread the first circuit is the same as in the last case. The coefficient of self-induction depends upon the shape of the circuit, the number of turns of the conducting wire, and on the surrounding medium, and the coefficient of mutual induction depends upon these properties for each circuit and upon their relative positions.' It can be shown that inductance plays the same part in the phenomena of electric currents that inertia or mass does in the motion of matter. The practical unit of induction is the henry (q.v.).

INDUCTION BALANCE. An instrument to determine the presence or character of a piece of metal, which may be either concealed, as a bullet in a human body, or in the form of a counterfeit coin or alloy. It was originally devised by Dove in 1841, but was improved and constructed in a serviceable form by Hughes in 1879. It consists of two sets of induction coils in which the primaries are connected together in a circuit that includes a battery and a microphonic or other circuit-breaker, while the secondaries are in connection with a telephone used by the observer. The current traverses the primary coils in opposite directions, and the secondary coils are so arranged that the sound of the microphone or circuit-breaker is not heard, owing to the inductive effect being neutralized completely. If a coin or other metallic substance is introduced into the vicinity of one of the pairs of coils, this equilibrium will be disturbed, as part of the induction acts upon the metal and gives rise to induced currents. This of course produces an audible sound in the telephone. The instrument is also used to measure hearing, and it then is known as an audiometer, the perception of sound being tested by altering the positions of the coils. An arrangement of the induction balance was devised by Prof. Alexander Graham Bell to locate a bullet in the human body, and apparatus based on the foregoing principle was employed and numerous different forms made and tested. It was used in an attempt to discover the bullet by which President Garfield was killed, but the presence of the metallic mattress interfered with the operation of the instrument. Instances, however, of its successful use are on record. Consult: Bell, "Induction Balance," in *American Journal of Science* (New Haven, 1883); Hopkins, *Experimental Science* (New York, 1890).

INDUCTION COIL. A form of electrical apparatus used for transforming an interrupted current of low potential or pressure into one of high potential and alternating in direction. The fundamental fact of electro-magnetic induction was first stated by Michael Faraday in a paper presented to the Royal Society on November 24, 1831, in which he derived the conclusion that any change in a magnetic field will induce an electric current in a conductor situated in it. This basic principle of electro-magnetic induction underlies the construction and operation of the induction coil. As regards its construction, it consists of four essential parts: A bundle of soft

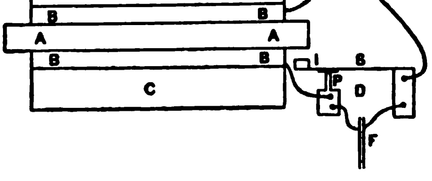

FIG. 1. DIAGRAM OF INDUCTION COIL.

iron wire, AA (Fig. 1), called the core; the 'primary coil,' BBBB, of insulated copper wire wound on the iron core, which is usually made of comparatively large wire and short in length; a much larger 'secondary coil,' CC, of longer, finer copper wire; and a device, D (Wagner's hammer, 1839), called the rheotome or interrupter, which alternately makes and breaks the connection of an electric current through the primary coil. In dimensions they vary from a few inches in length and a fraction of a pound in weight to those of large dimensions used for wireless telegraphy described below.

The operation of the apparatus is as follows: The small spring S, being in contact with the point P, allows the current from the battery E to flow through the primary coil, converting it and its core into a powerful electro-magnet. The production of this powerful magnetic field in and around the secondary coil induces in it a momentary current of high potential, and opposite in direction to the primary. This secondary current is usually able to pass as a spark between the terminals of the secondary TT. When the core AA becomes magnetic it attracts the piece of soft iron I on the spring S and draws it up, thereby breaking the connection between the spring S and the point P, and interrupting the flow of current in the primary. Thereupon the electro-magnet AB loses its magnetism, and, ceasing to attract the iron I, the spring returns to its original position, restoring the contact between S and P and again starting the current in the primary. The disappearance of the magnetic field on breaking the primary circuit induces a momentary current of high potential in the secondary coil in the same direction as the primary current, and hence in the opposite direction to the current induced in the secondary upon starting the current in the primary. The above cycle of operations repeats itself periodically, at a rate depending upon the spring S. Many modifications of the interrupter are used, some attached directly to the coil, as above described, some operating independently, but still electro-magnetically, and yet others are driven by an independent motor and are purely mechanical. Fig. 2 illustrates a form due to Foucault. One circuit runs from the binding post k' through the magnet D, pulling down the armature *a* supported by the spring *c*, and lifting the wire B out of the mercury cup B', interrupting the current, whereupon *a* springs up and B enters the mercury, again starting the current. This device may be introduced into the primary circuit of an induction coil, or the latter may be connected to the posts F, H, K, so as to use the wire A and cup A' for interrupting the current for the induction coil, while B' operates to keep the apparatus in motion. A commutator consisting of a hard rubber cylinder with metal contact pieces is shown at I, with binding posts at *n* and *m*. Fig. 3 shows another form of interrupter attached to an early form of induction coil. Fig. 4 shows the latest improvements—a Queen coil, with independent mechanical interrupter, capable of giving a 46-inch spark.

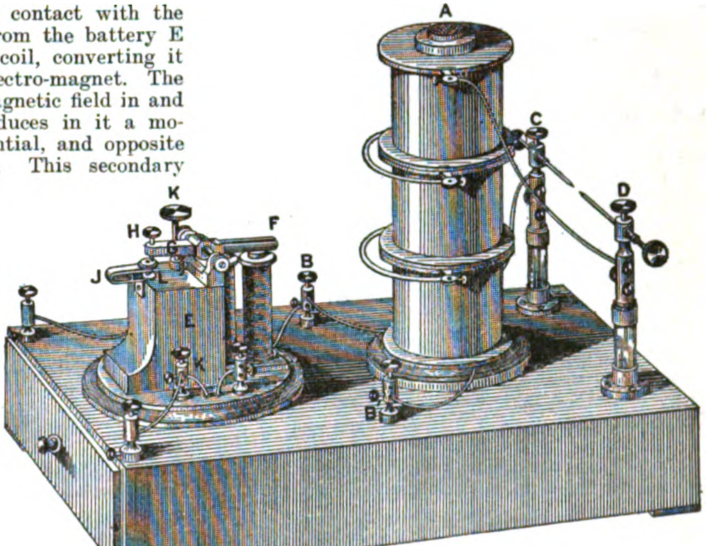

Fig. 3. EARLY RITCHIE INDUCTION COIL.

A, Core of iron wire; B B', binding posts of primary circuit; C D, binding posts of secondary circuit; E, standard carrying interrupter; F, armature; G, tension spring; H, contact screw; J, contact spring; K, binding post; L, contact point.

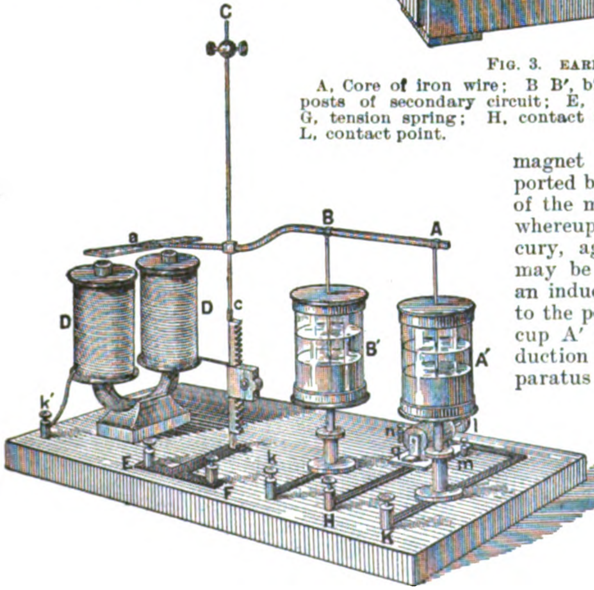

Fig. 2. FOUCAULT INTERRUPTER.

In some cases an alternating current is used in the primary without an interrupter; then the induction coil becomes practically a transformer, and the action is essentially the same as in apparatus of this class. See TRANSFORMER.

The quantity of electricity moved at the break is equal to that moved at the make in the primary circuit; but, owing to the fact that the magnetism in the core vanishes much more rapidly at the break than it builds up at the make, the effect at the break is more compressed, and the potential, or electrical pressure, much greater than at the make. The suddenness of the break is of the greatest importance, and most of the improvements in interrupters have been designed to make the break as sharp as possible. The important factors which affect the potential or length of spark produced by an induction coil are the relative number of turns of wire in the primary and in the secondary, the suddenness of the break, and the voltage or potential of the current used in the primary coil.

Pohl in 1835 made a very crude induction apparatus of a different style; but the first to make large coils of the above type were Stöhrer and Ruhmkorff, and from the latter is derived the name 'Ruhmkorff coil,' which is frequently used as a synonym of induction coil. In 1855 Poggendorff increased the suddenness of the break by so arranging the device that the interruption occurred under an insulating liquid or in vacuo. (The cups B′ A′ in Fig. 2 have alcohol over the mercury.) In 1857 Ritchie, of Boston, devised a means of winding the secondary coil in sections, like circular disks, which, laid together and connected, formed the cylindrical coil. This obviated to a great extent the danger of a spark jumping across from one turn of the secondary to another through the insulation. Ruhmkorff was so impressed with the superiority of a Ritchie coil exhibited in Paris that he adopted the Ritchie method of winding, and it prevails at present.

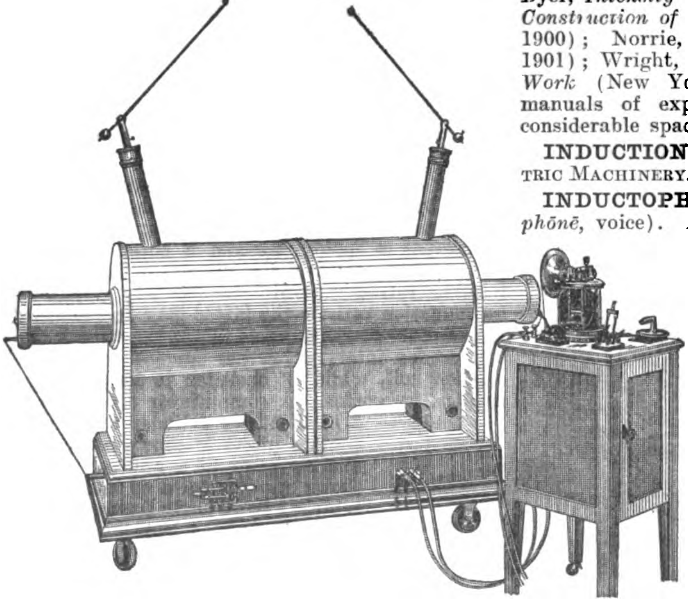

FIG. 4. QUEEN COIL.

Poggendorff proposed, and in 1853 Jean tried with good success, the use of a liquid as the insulation of the secondary, and at present most of the high-potential coils use liquid insulation. The advantage lies in the fact that if a spark should jump over, the hole in the insulation would immediately close. Fizeau suggested a decided improvement in 1853, introducing a condenser at the break, as shown at F (Fig. 1). This enables the extra current of the primary to run into the condenser for an instant, while the points S and P are first separating, and by the time that F is charged P and S are too far apart for the current to jump across.

In 1869 a coil was built for the London Polytechnic Institute the core of which was 5 feet long, 4 inches in diameter, and weighed 123 pounds. The primary had 6000 turns of wire 0.095 inch in diameter and 3770 yards long, weighing 145 pounds. The wire of the secondary was 0.015 inch in diameter and 150 miles long. This coil gave a spark 29 inches long and could penetrate more than 3 inches of glass. The modern coil shown in Fig. 4 gives a spark 46 inches long.

The induction coil is especially used in the study of the electric discharge in rarefied gases, as in Geissler, Crookes, and X-ray tubes; also in electro-therapeutics, and more recently for X-rays and wireless telegraphy. Although the static machines have supplanted the induction coil in the best X-ray laboratories, it still holds its place in wireless telegraphy. It was by means of such a coil that Heinrich Hertz carried out his brilliant researches which led to the discovery of electric waves, thus confirming the great theoretical hypothesis of Maxwell, and laying the foundation for wireless telegraphy.

Consult: Alsopp, *Induction Coils and Coil-Making* (New York, 1896); Bonney, *Induction Coils: A Practical Manual for Amateur Coil-Makers* (New York, 1892); *Induction Coils: How Made and Used*, an American reprint of Dyer, *Intensity Coils* (New York, 1892); Hare, *Construction of Large Induction Coils* (London, 1900); Norrie, *Induction Coil* (New York, 1901); Wright, *The Induction Coil in Practical Work* (New York, 1901). All of the large manuals of experimental physics also devote considerable space to this class of apparatus.

INDUCTION MOTOR. See DYNAMO-ELECTRIC MACHINERY.

INDUCTOPHONE (from *induct* + Gk. φωνή, *phōnē*, voice). A form of apparatus consisting of coils of wire and a telephone receiver, designed to afford communication between moving trains and stations. The apparatus and system were devised by Willoughby Smith, of London, in 1882, but never have been practically applied. Signals were transmitted inductively from coils of wire placed along the line to other coils in the train and received by means of a telephone.

INDULGENCE (Lat. *indulgentia*, indulgence, from *indulgere*, to indulge). A term of Roman Catholic theology, signifying the remission of temporal penalties due to sin, by one who has the power to distribute the spiritual treasures of the Church. An indulgence is not believed to remit guilt; only sacramental absolution avails for that; but it affects the punishment which would otherwise be inflicted in the regular exercise of ecclesiastical discipline. According to Bellarmine's statement, one who has been absolved from guilt in the sacrament may be released from penalty by an indulgence. It is an act, not of 'order,' but of 'jurisdiction,' based upon the power of the keys. (See KEYS, POWER OF.) So complete is this power held to be that the efficacy of an indulgence is believed, in a true sense, to satisfy divine justice, as well as to secure the remission of temporal penalties, whereby it is made to extend beyond this present life into the state of purgatory. The ground of this satisfaction is sought in the treasure of merit laid up by Christ and the saints, and always at the disposal of the Church whenever need requires. This *thesaurus meritorum* is fundamental to the fully developed theory of indulgences. The clergy are its duly appointed custodians; its beneficiaries are the adherents of the Church throughout the world who avail themselves of its virtues; the indulgence is its channel of communication.

The history of indulgences begins with Roman law, where the word *indulgentia* means the remission of a punishment or of a tax. From legal the word easily passed into ecclesiastical usage. A sovereign Church, like a sovereign State, might exercise clemency, instead of exacting the full measure of punishment which the law required. But long-continued, and sometimes bitter, controversies indicate the doubts which many Christians felt as to the propriety of this contention, which finally led to the catastrophe of the sixteenth century, when Luther voiced the protest of a large section of Christendom against certain current abuses of the doctrine. The first important step toward establishing the dispensing power of the Church was taken in consequence of the Decian persecution, beginning A.D. 250, when the problem arose how to deal with the lapsed. These questions were answered by the beginnings of penitential discipline. The further question of the relaxation of discipline was also answered on the side of mildness. The power of 'loosing' was declared to be no less real than the power of 'binding' (cf. Matt. xvi. 19). Ambrose especially taught that the two were correlative, and the Church accepted his view. But the Council of Ancyra (A.D. 314) had already sanctioned the use of clemency, at the discretion of the bishop, and this position had been indorsed by the first Ecumenical Council at Nicæa (325). Appeal was made to the example of Saint Paul, who recommended a degree of mercy toward the offender in Corinth (see II. Cor. ii. 6-8). The main exercise of this power, in the fourth and fifth centuries, was in shortening the canonical periods of penance, evidence of which is found, for instance, in the teaching of Gregory of Nyssa.

By degrees a variety of substitutes for the canonical penalties were introduced. Fasting might be remitted in consideration of repeating a certain number of psalms, or of paying a fine (as by Theodore of Tarsus, Archbishop of Canterbury, in the seventh century). Almsgiving, pilgrimages, and holy wars came to be the most popular means of securing indulgences, especially in the period of the Crusades (q.v.). The Council of Clermont (1095) asserted that the pilgrimage to the Holy Land took the place of all other penance. With the decline of the Crusades indulgences were offered for fighting against heretics, such as the Albigenses and Hussites (q.v.). The first great jubilee indulgence was published by Pope Boniface VIII. in 1300. The fully developed scholastic theory upon which indulgences are based is found in Thomas Aquinas and Alexander of Hales. The importance there attached to the 'treasure of merit' naturally led to a popular belief among the ignorant that pardon for sin and immunity from punishment were matters of ecclesiastical bookkeeping—that they could be bought and sold. It was in view of this popular impression, and the undoubted abuses which grew out of it, that Luther published his theses on indulgences in 1517, the event which marks the beginning of the Protestant Reformation. See LUTHER.

The Council of Trent, at its twenty-fifth session (1563), condemned those who assert that indulgences are useless, or deny that the Church has power to grant them; but in reaffirming its belief the Church decreed the abolition of all evil gains and other abuses which had grown up in connection with the indulgence system. Since that time the Church has attempted to guard against misinterpretations of the doctrine, and to safeguard it from the criticisms to which it had previously been exposed.

From what has been said it will be evident that Roman Catholics do not understand by an indulgence a remission of sin itself, much less a permit to sin, or a pardon for the future. They hold that its benefits can be enjoyed only by a sinner who has repented and resolved to lead a new life, and they deny the charge that the indulgence system has introduced any laxity of principle into the Church.

The power to grant indulgences for the whole Church resides only in the Pope, but primates, archbishops, and bishops have power to grant them within their own jurisdictions. The indulgence may be either plenary or partial, the former remitting the whole of the temporal punishment, the latter something less than the whole. For example, an indulgence of forty days is understood to remit as much as would have required forty days of penance without it. Indulgences may be attached to certain articles (e.g. a crucifix), or to certain places (as a shrine). In these cases the original possessor of the article, or the pilgrim to the shrine, receives the benefit of the indulgence. A custom of granting indulgences for the dead grew up in the Middle Ages. The right and efficacy of such grants has been much debated; but the Church holds them to be salutary, even though their precise scope cannot be defined. As limited by Sixtus IV. (Constitution of 1477), they are 'only by way of suffrage'—i.e. the Church does not assume direct authority over the dead.

Consult: E. Amort, *De Origine, Progressu, Valore ac Fructu Indulgentiarum* (Augsburg, 1735); Palmieri, *Tractatus de Pœnitentia* (2d ed., Prati, 1896); H. C. Lea, *History of Auricular Confession and Indulgences in the Latin Church*, vol. iii., "Indulgences" (Philadelphia, 1896); "The Roman Catholic Doctrine of Indulgences," by the Bishop of Newport, in the *Nineteenth Century* (January, 1901); Addis and Arnold, *Catholic Dictionary* (2d ed., London, 1884), article "Indulgence."

INDULT (Lat. *indultum*, indulgence, from *indulgere*, to indulge). A term derived from the

Roman Imperial codes, and used in canon law to designate an exceptional concession or privilege granted by the Pope to one or more persons. The best-known examples apply to the privilege allowed in certain cases to kings and other rulers of nominating to bishoprics and ecclesiastical benefices; thus Francis I. of France received this power when the Pragmatic Sanction was abolished in 1516. Indults were frequently granted in the Middle Ages allowing perpetual non-residence at the same time that the income was drawn; but this practice was abolished by the Council of Trent, except that canons who have a record of forty years' irreproachable service are dispensed by indult from further residence in the seat of their chapter. Temporary indults of this nature are frequently granted for absence on important ecclesiastical business.

INDUNO, ĕn'dōō-nō, Girolamo (1827-91). An Italian painter, born in Milan. He studied at the Milan Academy, and first exhibited in the Paris Salon in 1855. His pictures are mainly of military or of humorous genre subjects. They include: "Garibaldi's Soldiers" (1855); "A Vivandière;" "Dancing Lesson in the Last Century;" "A Souvenir of Rome;" and "The Musicians."

IN'DUS (Lat., from Gk. *Ἰνδός*, from Skt. *śindhu*, river). The great river that bounds India on the west, separating it from Afghanistan and Baluchistan (Map: India, A 3). It is over 1800 miles long, and the drainage area of its basin is estimated at 372,000 square miles. It rises 50 miles southeast of Gartok, an important trading centre in Tibet, its source being 15,000 feet above the level of the sea, on the north side of Kailas, a Himalayan peak, 22,000 feet high. Its general course, till it forces its way between the Himalaya proper and the Hindu Kush, is toward the northwest. It flows past Leh, the capital of Ladak; receives the waters of its important Trans-Himalayan tributary, the Shyok, from the north; and after a descent of 11,000 feet in a course of 500 miles, through some of the grandest mountain scenery of the world, about 60 miles below Iskardo bends sharply southward, above the confluence of the Gilgit. It flows past Bunji, on the Kashmir-Kohistan border, and 20 miles below takes a western course to Kotgata, where again it turns southward, and at Darband emerges from the Kohistan Mountains into the plains of the Punjab. It becomes navigable at Attock (ancient Taxila), the scene of Alexander the Great's passage, 870 miles from its source. Here it receives the Kabul River (q.v.), its chief affluent on the right. Continuing past Dera Ismail Khan, Dera Ghazi Khan, and other minor towns, near Mithankot, about midway in its further course of 940 miles to the Arabian Sea, it receives the waters of the Chenab, the Ghara, the Jhelum, the Ravi, the Beas, and the Sutlej, through the Panjnad (literally 'five rivers,' which gives its name to the Punjab). Each of these rivers, as well as the Kabul, is practicable for inland craft to the mountains.

Below the confluence of the Panjnad the volume of the Indus, past Sakkar and Hyderabad, becomes gradually less. Through the arid, rainless, alluvial plain of Sindh it divides into numerous channels, many of which do not return to the main stream, while others return much shrunken in volume. This wasting of the waters is not very apparent to the eye, owing to the gradual slackening of the current and the ascent of the tides. Miani, 8 miles north of Hyderabad and 75 miles from the sea, is the head of the delta which extends for 130 miles along the coast of the Arabian Sea. The chief outlets of the Indus are the Kori, Mal, and Yatho mouths. The annual rise of the river, owing to the melting of the mountain snows, extends from May to August, and is often attended by considerable inundations and changes of the deltaic channels, chiefly owing to the enormous amount of sand and clayey silt brought down by the current. Modern engineering has done much to obviate the inconveniences caused. The value of the Indus as a navigable route of traffic, never considerable, has been lessened since the building of railways through its valley from Karachi to Attock, and navigation is now confined to native craft. In a hot climate, where precipitation is almost nil, the river is more important as a means of irrigation, and the various works toward this end inaugurated by the British Government have led to a remarkable agricultural development throughout Sindh. The river is spanned by several modern bridges, of which the chief is the huge cantilever bridge at Sakkar, and the northernmost an iron suspension bridge above Bunji. Fish of excellent quality abound in its waters, and form the staple article of commerce and food of the surrounding country. The gavial, or long-snouted alligator, is the amphibious reptile of the river. The Indus is the 'King River' of Vedic poetry.

INDUSIUM, ĭn-dū'shĭ-ŭm *or* -zhĭ-ŭm (Lat., tunic). In ferns, a flap-like outgrowth which covers the sorus or group of spore-cases (sporangia). Indusia are exceedingly varied in structure, and furnish characters for classification. Occasionally the sporangia are developed along the leafy margin which inrolls to cover them, as in the maidenhair fern and the common bracken. In this case the inrolled leaf-margin is spoken of as a 'false indusium.' See Fern.

INDUSTRIAL ACCESSION. A phrase borrowed by the Scotch from the Roman law to denote the increased value given to a thing by labor and skill bestowed upon it. See Accession; Fixture.

INDUSTRIAL ARBITRATION AND CONCILIATION. Modern industry, with its sharp distinction between employer and employed, and its rapidly changing methods of production and conditions of employment, has given rise to a new class of disputes, which affect vitally not only the parties immediately concerned, but the general public as well. These disputes lie for the most part beyond the province of courts of justice, and therefore an imperative need has arisen for a new form of tribunal to which they may be referred. To meet this need, boards of arbitration, official or unofficial, have been organized in all of the leading countries of the world.

A preliminary function of these organs of industrial arbitration is what is usually termed *conciliation*. Before a dispute can be arbitrated it is necessary that the facts in the case should be investigated and placed in their true light. When industrial disputes result from mere misunderstandings—and it is safe to affirm that a majority of them have no deeper origin—the preliminary investigation may suffice to bring the contending parties to an agreement. It is therefore natural that the work of settling disagreements of this kind should be assigned to two bodies, a board of conciliation, which investigates each case and attempts to clear away misunderstandings, and a board of arbitration, which gives awards on the cases in which more essential points are at issue. Where, however, boards of conciliation and arbitration are actually organized separately, their relation is often merely that of a lower and an upper court, the organ of conciliation giving awards, subject to revision in the board or court of arbitration.

Arbitration and conciliation may be voluntary or compulsory. In the former case, the organ of arbitration may be created by the contending parties, or may be officially constituted; but either party is free to refuse its services or to accept its awards. When arbitration is compulsory, disputes must be arbitrated at the request of either party, and decisions of the court of arbitration are sanctioned by legal penalties.

The earliest systematic arbitration of industrial disputes appears in France. Before the French Revolution there was a tribunal at Lyons for the settlement of disagreements arising in the silk trade. This tribunal was connected with the guild, and disappeared with the abolition of corporations (1791). It had worked so successfully that it was restored in 1808, forming the germ of the conseils des prud'hommes (boards of experts) which still perform this function in France and Belgium. The example of Lyons was soon followed by several cities in Southern France, and with excellent success. These early boards contained no representative of the working classes, the one at Lyons being composed of five merchants and four overseers. By a law of 1809 workmen were admitted, but they were always in the minority until 1848, when they were given, for a short time, equal representation. At the present day, the conseils des prud'hommes are found in all of the important cities of France. They are composed of a board of conciliation, consisting of a representative of the workmen and a representative of the employers, which has jurisdiction in disputes involving less than 200 francs, and a board of arbitration consisting of three employers and three workmen, whose findings are subject to appeal to the Tribunal of Commerce in cases involving more than 200 francs. The court of arbitration has power to summon witnesses and to take testimony under oath. Acceptance of the decision is voluntary. Nevertheless, two-thirds of the cases brought before the court are settled by the board of conciliation; only a small percentage are appealed to the tribunal of commerce. It is, however, only minor matters that are brought before the courts. They have proved unable to prevent strikes and lockouts, which in late years have seriously crippled French industry. In Prussia industrial courts were established in 1849, but did not prove to be of much use, and were later abolished. In 1890 an Imperial law authorized the municipalities to create such courts. The president is appointed by the commune; the assessors must be workmen and employers in equal numbers. They have power to summon witnesses and to take testimony; in cases involving 100 marks or more, appeal to the regular courts is permitted. Few municipalities have availed themselves of the privilege. Moreover, unofficial arbitration has made little headway in the Empire. In Switzerland far greater progress has been made in this direction. Unofficial arbitration is carried on under the direction of trade unions, and several of the cantons have established conseils des prud'hommes, after the French model. Arbitration is compulsory in some of the cantons, notably Luzerne, where refusal to accept an award may be punished by fines and imprisonment; in some cantons it is optional, as in France.

In England voluntary and unofficial arbitration was instituted early in the nineteenth century, and has made greater progress than in any other country. In 1836 disputes in the pottery trade were settled in this way; and within the following decades several important trades adopted the same practice. Committees of employers and employed meet informally to discuss grievances, and usually succeed in reaching an amicable agreement; and where these committees are best organized, as in the coal trade of Durham, the decisions of the committee are rarely rejected by the disputants. In the last decade, upon the initiative of the London Chamber of Commerce and the trade unions, local boards not connected with any particular trade have been created in large numbers, and have been successful in diminishing the number of serious disturbances in industry. But in England, as in France, the more important disagreements have had to be adjusted by protracted and costly strikes and lockouts.

New Zealand enjoys the distinction of being the only country which undertakes systematically to prevent strikes and lockouts by a general law of compulsory arbitration. In 1894 a law was enacted creating boards of conciliation and a court of arbitration, the latter having power to enforce its awards by penalties. The boards of conciliation consist of four to six members, one-half representing the labor associations, the other half representing associations of employers. They are elected every three years by the associations of employers and employed. Each board elects as chairman an impartial outsider, who votes in case of a tie. The arbitration court is composed of three members appointed by the Governor, one from a list nominated by the employers, a second from nominees of the laborers, and the third from the judges of the Supreme Court. Cases are tried before the court only upon the request of one of the disputants, and all means of conciliation are attempted before resort is had to arbitration. Strikes and lockouts are forbidden while the case is pending. Awards of the court may be extended to a whole district. Under the act trade unions are recognized as corporate bodies; and only by belonging to such a body does a workman secure standing in the court. Numerous disputes have been settled by the court, and light fines have hitherto been sufficient to enforce its awards.

The first noteworthy case of unofficial arbitration in the United States was in 1865, when a committee was appointed to arbitrate differences between the Sons of Vulcan and their employers. Since that date arbitration committees have been chosen in many trades, often operating with marked success. Much attention has been attracted by the signal success of an unofficial board which operates in the coal-mining industry of Illinois. The activity of this board dates from 1898, and since that year innumerable grievances which might have led to strikes have been amicably adjusted. When such disputes arise, representatives of the coal operators and of the United Mine Workers (q.v.) meet, together with the miners and operators immediately interested. The mere discussion of the points at issue frequently results in explaining away alleged grievances.

Official boards of arbitration were established in Massachusetts and New York in 1886. At present twenty-four States in the Union have made statutory or constitutional provision for industrial arbitration or conciliation. Seventeen of these contemplate the administration of arbitration through permanent boards: Massachusetts, New York, Montana, Michigan, California, New Jersey, Ohio, Louisiana, Wisconsin, Minnesota, Connecticut, Illinois, Utah, Indiana, Idaho, Colorado, and Kansas. The Constitution of Wyoming directs the Legislature to establish courts of arbitration to determine all disputes between employer and employed. Provision is made for appeals to the Supreme Court from the decision of compulsory boards of arbitration. Kansas enacted compulsory arbitration in 1898, but in the following year the enactment was declared unconstitutional. In addition to the State courts, temporary tribunals were created by Federal statute in 1888 to settle grievances between railroads engaged in interstate commerce and their employees. These tribunals consisted of one member chosen by each party, and a third chosen by these two. The law was repealed in 1898, but was reënacted in the same year in its essential features.

The organization of the State boards varies in detail, but the feature of equal representation of employers and employed is general. Their principal function is to investigate disputed questions, conciliation rather than arbitration being the end in view. In Massachusetts the arbitration board has power to summon witnesses, to take testimony under oath, and to require books and writings to be produced. The results of the investigation may be made public at any point in the proceedings. In other States the powers of the courts or boards are generally of a similar nature. The Massachusetts board has won a national reputation for efficiency, and while unable to prevent all strikes, has unquestionably done much to diminish their frequency.

An examination of the workings of boards of voluntary arbitration shows that for the settlement of disputes which are due to misunderstandings, or which involve matters of minor importance, their usefulness is unquestioned. Wherever they have been judiciously conducted they have served to lessen friction between employer and employed, and have often averted strikes and lockouts. But there are certain questions of general policy which have defied settlement by voluntary arbitration. Such, for example, are the recognition of labor organizations by the employer, exclusion of non-union labor from employment, a general and material increase or lowering of wages. These questions are still usually determined by the strength and endurance of the contending parties. Investigations by impartial boards of arbitration may direct public sentiment, and so may bring pressure to bear upon the party whose ethical position is the weaker. But this pressure has not proved sufficient to prevent prolonged strikes, causing widespread distress to the public, as well as to the parties to the struggle. It is for this reason that a growing sentiment manifests itself in favor of compulsory arbitration. It is pointed out that under a system of industrial concentration a strike may wholly cut off the supply of one of the necessaries of life—a condition which is manifestly intolerable. Advocates of compulsory arbitration point to the example of New Zealand, where for seven years disputes have been adjudicated without cessation of industry. Opponents of compulsory arbitration are, however, no less decided in their views than are the advocates of it. It is pointed out that laborers will frequently demand terms to which employers can accede only by producing at a loss; and that courts of arbitration, under the influence of a public sentiment naturally favorable to the laborer, will often give awards which will discourage business enterprise. It is alleged that this is the case in New Zealand, although this is vehemently denied, and there is no evidence that capital is withdrawing from the colony. Moreover, it would obviously be difficult to force the laborers to abide by a decision unfavorable to them, since men cannot be compelled to continue to work against their will. The incorporation of laborers into associations with collective responsibility (see TRADE UNIONS) is advocated as a measure which will obviate this difficulty; but such a measure is strongly opposed by the better organized labor unions, as well as by those who view with suspicion any tendency away from individual freedom and responsibility. In spite of the difficulties which beset compulsory arbitration, however, it would appear to be obvious that social welfare demands that judicial means should be developed for settling peacefully those disputes which can now be settled only through strikes involving untold losses and suffering.

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INDUSTRIAL COMMISSION. A non-partisan commission, created by act of Congress, June 18, 1898, to investigate industrial conditions, and to suggest Federal and State legislation for the better regulation and adjustment of conflicting industrial interests. The commission consisted of 19 members, of whom 5 were Senators, appointed by the president of the Senate, 5 Representatives, appointed by the Speaker of the House, and 9 especially qualified persons, appointed by the President with the consent of the Senate. The specific duties of the commission were, first, to investigate questions of immigration, labor, agriculture, manufacturing, and business, and, second, to suggest, on the basis of the facts ascertained, proper Congressional legislation and also uniform State legislation, equitable at once to employer and employee, producer and consumer. The life of the commission was limited to two years, but this time was subsequently extended to December 15, 1901, and to February 15, 1902, successively. The work of the commission, owing to the inevitable preoccupation of its Congressional members, in their own and in public affairs, was largely carried on by the Presidential appointees, and by specially engaged experts. Of the latter may be mentioned: on strikes and arbitration, E. Dana Durand; on labor legislation, Frederic J. Stimson; on trusts and industrial combinations, Jeremiah W. Jenks; on transportation, William Z. Ripley; on agriculture, John F. Crowell; on immigration, John R. Commons; on taxation, Max West; on labor organizations, Charles E. Edgerton. The fact that no equally competent body of men, empowered to call for witnesses and documentary papers, had ever before examined American industrial methods and organizations, together with the fact that the period of prosperity succeeding 1897 brought industrial phenomena into accentuated relief and activity, resulted in the commission's bringing together a great body of new correlated and substantiated evidence concerning practically every phase of industrial life. Testimony was taken from nearly 700 witnesses, including heads of trusts, railroads, and mercantile establishments, public officials and leaders of trade unions, and in addition the commission collected much valuable but hitherto scattered information from official, national, and State documents, from judicial decisions, and from the researches of experts. The *Report of the Industrial Commission*, completed February 19, 1902, and issued as a Government publication, consists of 19 volumes, as follows: Trusts and Industrial Combinations (2 vols.); Trust and Corporation Laws; Prison Labor, Transportation (two vols.); Labor Legislation; Distribution of Farm Products; Capital and Labor in Manufactures and General Business (two vols.); Chicago Labor Disputes; Agriculture and Agricultural Labor; Agriculture and Taxation; Capital and Labor in the Mining Industries; Immigration and Education; Foreign Labor Legislation; Labor Organizations; Labor Disputes and Arbitration; Railway Labor; Industrial Combinations in Europe; Final Report—Miscellaneous.

INDUSTRIAL EXHIBITIONS. See EXHIBITIONS, INDUSTRIAL.

INDUSTRIAL FRUITS. In Scotch law, the annual produce of land which the life-renter is entitled to. For the corresponding doctrine of English and American law, see EMBLEMENT.

INDUSTRIAL INSTITUTIONS. See AGRICULTURAL EDUCATION; JUVENILE OFFENDERS.

INDUSTRIALISM. A term first applied by Saint-Simon and his followers to the 'modern régime,' but also to the peculiar systems of social organization which they advocated. In his *Data of Ethics* Spencer uses the term as descriptive of "a theoretically possible form of society purely industrial in its activities." Pure 'industrialism' according to Spencer would be reached when men were scrupulously honest in the fulfillment of agreements, while yielding "to one another no advantages beyond those agreed upon."

The meaning to be attached to the term has not yet been definitely established. By some it is employed to characterize the modern industrial system in which manufacturing industries predominate; others employ it as a description of modern civilization as opposed to the 'militarism' of preceding times. (See IMPERIALISM.) The definition which has been most generally accepted agrees in the main with Spencer's conception. This is exemplified by the deprecations of the 'industrialism' of modern life, found in literature and religious writings.

INDUSTRIAL REVOLUTION. In the latter part of the eighteenth century and the early part of the nineteenth the economic life of England underwent a great transformation, which has aptly been called the Industrial Revolution. As late as 1760 the 'open-field' system (q.v.) was the prevailing characteristic of British agriculture. Even in 1794, when the process of inclosing the commons and open fields had been progressing rapidly for a quarter of a century, out of 8500 parishes in England 4500 were still farmed in common. Great stretches of country lay quite unimproved; extensive bogs and heaths were found in all parts of the island. In many counties the miserable crops merely afforded sustenance to the agricultural population. The means of transportation were so defective that in one county surplus produce went to waste, while in an adjoining county scarcity prices prevailed. Industry was carried on by the domestic system, under which the manufacturer or merchant put out his materials to be worked up in the laborers' homes at piece wages. Exchange was still carried on largely by means of weekly markets, annual fairs, and through itinerant traders. British foreign trade was, however, increasing rapidly, and with the increased demand for goods prices of manufactures rose, affording the means of supporting a larger industrial population. The increased need for food rendered systematic agriculture more profitable; and the development of capital diverted much wealth to husbandry. A number of wealthy gentlemen turned their attention to the improvement of stock and the proper treatment of the soil (see AGRICULTURE), and demonstrated that agriculture could furnish returns rivaling those of trade, with the result that methods of agriculture were revolutionized. The Continental wars enhanced the prices of agricultural produce, and gave a great impetus to the adoption of the new methods. Between 1760 and 1843 nearly 7,000,000 acres of land were inclosed and put to intensive tillage.

At the same time, the domestic system in industry was giving way to the factory system, as a result of the great mechanical inventions. In 1770 Hargreaves patented the spinning-jenny; the water-frame was invented by Arkwright in 1769; Crompton's mule was introduced in 1779. In 1769 Watt obtained his first patent for an improvement in the steam-engine, and in 1785 it was successfully applied to the cotton manufacture. The effect of these inventions was enormously to increase output, the cotton manufacture trebling from 1788 to 1802. The iron industry, which had hitherto been relatively insignificant, and was dwindling to still greater insignificance with the destruction of the woods, was revived by the employment of pit-coal in smelting, rendered possible by the application of the steam-engine to furnish power for the blast. The adoption in the woolen industry of the improvements in cotton manufacture extended the new system greatly. As a result of all these changes, English commerce, foreign and domestic, developed rapidly; shipping increased, good roads were built, and an era of canal-building set in. Industry shifted from the rural towns to the large cities of the north of England, where labor was concentrated in factories, with the effect of improving the organization of labor, and of making practicable numberless subsidiary labor-saving devices. Immense fortunes were made by those who were able to make use of the improved methods; population grew rapidly with the increased chances of employment. From 1791 to 1821 the population of England increased 43 per cent.

The period was, however, marked by a great deal of hardship to the working classes. The open-field farmers, displaced by inclosures, flocked to the cities and helped to reduce wages, at times, to a starvation level. The introduction of machinery deprived the hand workers of their means of livelihood; the crowding together of population in the large cities resulted in untold evils, moral and physical; the new life in the factory was not yet subjected to the regulations afterwards found to be imperatively necessary. The employment in factories of women and children, with all its attendant evils, became common in all the manufacturing towns. The general effect of the revolution, however, was to give England a century's start over her rivals in the competitive race. The foundations for the prosperity of England to-day were laid by the thorough change in industry. Consult: Toynbee, *Industrial Revolution* (6th ed., London, 1902): Held, *Zwei Bücher zur socialen Geschichte Englands* (Leipzig, 1881). See FACTORIES AND THE FACTORY SYSTEM.

INDUSTRIAL SCHOOLS. This term, now passing out of general use, has been variously and loosely applied to a large class of schools, mainly of a philanthropic, reformatory, or experimental nature, in which industrial work has been taught to boys and girls at a comparatively early age. This kind of school has been represented perhaps more fully than elsewhere in England, where the 'Ragged School' is a prominent type. The primary purpose of such schools is generally other than industrial, and the aim of the industrial instruction varies from the mere desire to keep boys off the streets to the serious effort to teach a trade. These institutions have not, however, filled the purpose of real trade schools, mainly on account of the early age of the pupils, and the short period of instruction. Simple operations like broom and brush making, chair-seating, or basketry, have been prominent in such schools; tailoring, shoemaking, and wood-working less so. Industrial classes, which represent the same characteristics as the above, are often a feature of orphan asylums or homes for juvenile defectives. On the whole, this type of school has not demonstrated any important function in training for industrial work, and its place in the social order, as has been pointed out, is mainly pathological. In the early discussion on the introduction of manual training into the common schools, the term 'Industrial Education' was very often applied to this subject. See TECHNICAL EDUCATION; MANUAL TRAINING; GEORGE JUNIOR REPUBLIC.

INDY, ăN'dē′, PAUL MARIE THÉODORE VINCENT, D' (1851—). A French composer and pianist, born in Paris. He copied closely the method and style of Berlioz, and, like Berlioz, his genius inclined strongly toward symphonic art. It was his mother who gave him his first practical instruction, and at fourteen years of age he was reckoned a master of the piano. From 1862 to 1865 he studied under Diémer, after which he studied theory under Lavignac, and attended the lectures of Marmontel. In 1870 he enlisted in the army, and at the conclusion of the Franco-Prussian War took up his studies under César Franck. In 1873 he became a member of the organ class at the Conservatory. Afterwards he was engaged as second kettle-drummer and choirmaster of the Société des Concerts du Châtelet, a post which he accepted as much for the study of the orchestra as for a means of livelihood. In 1885 he took over the management of the Société Nationale de Musique, and when César Franck became president of it, he acted as secretary, together with Chausson, and practically managed all its affairs. Besides his appointment of inspector of music in the city schools of Paris, he received the decoration of chevalier of the Legion of Honor, and was given charge of various important choral societies. He was a thorough disciple of Wagner, and by some has been charged with imitating too closely the German master. His *Leit-motifs* are usually developed with exquisite felicity, and he is frequently daringly original. His most important works are: the tripartite symphonic poem *Wallenstein*, of which the second part, *I Piccolomini*, was first produced by Pasdeloup in 1874; *Symphonie sur un air montagnard français;* and *La forêt enchantée* (1896). His one-act comic opera *Attendez-moi sous l'orme* (1882) was practically a failure, but he retrieved himself in 1895 with the music drama *Fervaal*, of which he wrote both words and music.

INEBRIETY. See INTOXICATION.

INED'UCABIL'IA (Neo-Lat. nom. pl., not educable, from Lat. *in-*, not + Neo-Lat. *educabilis*, educable, from Lat. *educere*, to educate, from *e*, out + *ducere*, to lead). A division of mammals, proposed by Gill, embracing the rodents, edentates, insectivores, and bats, based upon the character that in all these the cerebrum is small, and does not cover the olfactory lobes or cerebellum, as in other Eutheria. This division does not enter into current classifications. It is, nevertheless, approved as marking a fact of interest.

INEQUALITY (Lat. *inæqualitas*, from *inæqualis*, unequal, from *in-*, not + *æqualis*, equal, from *æquus*, even). The relation between two magnitudes which are not equal. If a 1-1 correspondence can be set up between the individuals of two groups, a, b, they are said to be equal. But if this correspondence extends to all of the individuals of a and to only a part of those of b, then $b>a$, and vice versa.

INERTIA, ĭn-ẽr'shĭ-ȧ (Lat., sluggishness, from *iners*, idle, from *in-*, not + *ars*, art). A general property of matter of which we become conscious through our muscle-senses whenever by our muscles we change the motion of matter, e.g. throw or stop a ball, open a door, stop a revolving wheel, etc. It is noticed that the intensity of the sensation depends both on the material body itself and on the *rate* at which its motion is changed. Similarly, if the motion of the body is stopped by some inanimate object, the effect on the latter is proportional to the rate of decrease and varies with the body stopped; e.g. if a moving body meets a spiral spring and compresses it until it is brought to rest. If two moving bodies are brought to rest by a given spring in the same time and produce the same amount of compression, they may be said to have the same inertia. (On this definition is based the system for measuring quantities of matter, q.v.). If it takes longer to bring the first body to rest, it is said to have the greater inertia. It is believed that, if there were nothing external to the moving body affecting it, it would continue to maintain its motion unaltered forever. Galileo was the first to advance this idea; and it is now assumed as one of the principles of mechanics. On the other hand, if there is some external action on the body it takes time to produce a change in its motion, and the change produced in a given time will vary inversely as the inertia; or, to produce a given change in motion, the external action required varies directly as the inertia. It is to Newton that we owe our ideas of inertia as a measurable fundamental property of matter. Up to his time weight was the only property of matter used as a measure of the 'quantity of matter.'

INESCUTCHEON (*in* + *escutcheon*, from OF. *escusson*, *escuçon*, Fr. *écusson*, escutcheon, from OF. *escut*, *escu*, Fr. *écu*, shield, from Lat. *scutum*, shield). In heraldry (q.v.), a single shield borne as a charge.

INES DE CASTRO, ē′nēs d*e* kä′strō. See Castro, Inez de.

INESILLA DE CANTARILLA, ē′nā-sē′lyȧ dā kȧn′tȧ-rē′lyȧ. In Le Sage's *Gil Blas*, a character who retained the power of charming men during the whole of a long life.

INEXPIABLE WAR, The. A war of extermination waged by Carthage against her unpaid mercenaries in B.C. 241-238. The scenes of this war are pictured in Flaubert's *Salammbô*.

I′NEZ, *Span. pron.* ē′nāth, Donna. In Byron's *Don Juan*, the mother of Don Juan.

INFALLIBILITY (from ML. *infallibilis*, infallible, from *in-*, not + *fallibilis*, fallible, from *fallere*, to deceive, Gk. *σφάλλειν*, *sphallein*, to overthrow, AS. *feallan*, OHG. *fallan*, Ger. *fallen*, Eng. *fall*). The immunity from error, in all that regards faith and morals, which is claimed by the Roman Catholic Church, and, at least as regards the past, by the Greek Church, as represented in the decrees of the councils which the latter looks upon as ecumenical. The latter claim, however, which does not go beyond that of inerrancy, or actual exemption from error up to the present time, differs widely from that of infallibility as put forward by the Roman Church, which involves not alone an actual historical immunity from error, but also such a positive and abiding assistance by the Spirit of God as will at all times both protect against the possibility of error, and guide and direct in the faithful teaching of all necessary truth. The infallibility claimed by the Roman Church is thus of two kinds, passive and active—the first (Matt. xvi. 18), in virtue of which the Church never can receive or embrace any erroneous doctrine, no matter by whom proposed; the second, in virtue of which she is charged with the function (Matt. xxviii. 19; Mark xvi. 15; Ephes. iv. 11-16) of permanently teaching to the world the essential truths of God, of actively resisting every access of error, and of authoritatively deciding every controversy by which the oneness of belief among the faithful may be endangered. Catholics regard this gift as a natural and necessary accompaniment of the authority in the matters of faith with which they believe the Church to be invested, and which, if not guided in its exercise by such infallible assistance, would be but a false light, and an attractive but dangerous delusion. They have always agreed that the body of bishops throughout the Church, acting in common with the Pope, constitute the most perfect organ of the infallibility of the Church; and hence, that when they unite in any way, whether as assembled in a general council or separated in place, their judgment is infallible. Thus, if a doctrinal decree were addressed officially by the Pope to the whole Church, and either expressly confirmed or tacitly accepted by the bishops, this decree was held to be infallible. In like manner, if a doctrinal decree, emanating even from a local council, as that of a national or even a provincial Church, should be universally accepted by the Pope and the bishops, that decree also was held to be infallible. In a word, wherever there is found the united judgment of the Pope and the bishops, all agreed in accepting it as the infallible judgment of the Church. But should the Pope alone judge without the bishops, there arose the well-known dispute of the Gallican and Ultramontane divines; the latter affirming, the former denying, the Papal judgment to be infallible, but all agreeing that it was not binding as an article of Catholic faith so long as it had not received the assent of the body of the bishops. The formal definition of Papal infallibility as *de fide* dates from the Vatican Council of 1870. The minority of bishops who opposed the decree did so, as a rule, not because they disbelieved the doctrine, but because they considered its imposition as a necessary article of faith inexpedient. As formally declared, the definition is that the doctrinal decrees of the Pope teaching *ex cathedra*—that is, when in discharge of the office of pastor and doctor of all Christians, by virtue of his supreme apostolic authority, he defines a doctrine regarding faith and morals to be held by the universal Church—are to be accepted as possessing the same infallibility which attaches to the teaching of the Church. See Council.

On the matter of subjects to which the gift of infallibility extends, Catholics are agreed in one principle, that it embraces all those subjects, and those only, which are necessary for the maintenance of divine truth in the Church. Hence, presupposing divine revelation, either written or oral, it embraces all questions of faith and morality, all subjects of general discipline, so far at least as to preclude the introduction, by authority of the Church, of any discipline which should be injurious to faith or to morality. On the other hand, it does not embrace questions of science, or matters of fact, or abstract opinions unconnected with religion. Thus the popular misconception that the decision in the case of Galileo bears on the question of this strictly defined infallibility is seen to be baseless. It may be well also to point out that the Pope is not supposed to have the power to invent and enforce new doctrines, but can only declare and define those which have been held either implicitly or explicitly in the Church from the beginning. See Foster, ***Fundamental Ideas of the Roman Catholic Church*** (Philadelphia, 1899); Hefele, ***Honorius und das sechste allgemeine Konzil*** (Tübingen, 1870); Salmon ***The Infallibility of the Church*** (London, 1888); Rive, ***Unfehlbarkeit des Papstes*** (Paderborn, 1870).

INFAMOUS CRIME (OF. *infameux*, from ML. *infamosus*, from Lat. *infamis*, infamous, from *in-*, not + *fama*, fame). An offense which is deemed to reveal such an absence of moral principle as to indicate that the culprit would totally disregard the obligation of an oath. Such crimes are punished according to their character, and the disabilities of infamy are imposed as an incident thereto. At the early common law treason, felony, forgery, and offenses tending to pervert the administration of justice by falsehood and fraud, such as perjury, conspiracy, and cheating, were included in this classification. The Constitution of the United States provides that "no person shall be held to answer for a capital or otherwise infamous crime unless on presentment and indictment of a grand jury." The Federal courts have included all crimes punishable by imprisonment in a State prison or penitentiary in this category, and many of the State courts have adopted their classification. See INFAMY. Consult the authorities referred to under CRIMINAL LAW.

INFAMY (from Lat. *infamia*, from *infamis*, infamous). The condition of legal disability imposed upon a person convicted of an infamous crime (q.v.). The term originated in the Roman law, under which system many derelictions of duty, such as a simple breach of certain contracts, as well as certain crimes, were punished with the civil and political disabilities of infamy. In the early English law the doctrine of attainder (q.v.) attached to the more serious crimes, and infamy only involved incompetency as a witness and incapacity to serve on a jury. The disabilities attaching to infamy are largely regulated by statute to-day, and in England and many of the United States all disqualifications on this account have been abolished.

INFANT. At common law, any male or female person under the age of twenty-one years. As the common law takes no account of a fraction of a day except when a question of property is involved, an infant is held to become of age on the day before the twenty-first anniversary of his birth. It has always been the policy of the law to safeguard infants from the consequences of their own indiscretion by modification of many of the rules of law applicable to adults. Thus an infant's contracts are voidable (not void like the contracts of married women). That is, they are binding upon an adult contracting with the infant, but they may be avoided by the infant upon the ground of his infancy; but if the infant expressly or by implication ratifies the contract after he is of age, the contract cannot be afterwards avoided by him. (See RATIFICATION.) Whenever an infant disaffirms his contracts he is entitled upon principles of quasi-contract (q.v.) to recover from the other party to the contract the reasonable value of the consideration or performance which he (the infant) has given under the contract, even though he has (before coming of age) squandered the consideration which he has received under the contract. If, however, the infant have any money or property which he received under the contract, he must return it to the other party to the contract in order to disaffirm the contract. While an infant is not bound by his contract, he is bound to pay for necessaries (see NECESSARIES) purchased by him, his liability being based on the theory of quasi-contract. An infant may also pledge his parent's credit for necessaries upon theory of implied agency if the parent does not supply them. A parent is not liable to pay for articles supplied to his child by a third person; but a parent may so act as to estop himself from denying the authority of the infant to act as his agent, as by regularly paying for articles purchased by the infant.

In general, infants are liable for their torts. Where, however, the effect of holding the infant for his tort is indirectly to enforce his contract, the courts have denied his liability in tort. The practical application of this rule involves some very nice discrimination for the court. Thus an infant who hires a horse, and so negligently cares for him that the horse is injured, is not liable for tort or upon his contract; but, if the infant appropriates the horse to his own use by going to some place other than that specified in the contract, he is deemed to have abandoned his contract and to be liable in tort. Similarly it has been held that, while an infant is generally liable for deceit (q.v.), one who fraudulently represents himself to be of full age and thereby procures another to enter into a contract with him is not liable for the tort, but the soundness of the position has been questioned.

An infant who is a property-holder is subject to the laws of taxation, and his land is liable to be taken from him by eminent domain as if he were of age. At common law a legal marriage might be contracted between a boy of fourteen and a girl of twelve. See AGE.

An infant if sufficiently intelligent to have criminal intent is responsible for any crimes that he may commit. It is a rule of the common law that this responsibility can never arise before the infant is seven years of age. After that period until he is fourteen the law presumes nothing for or against him. His capacity to understand the nature and consequence of his act must be proved by the prosecution in order to establish his guilt. After he is fourteen he is presumed to have capacity to commit crime, and the burden of creating a reasonable doubt of his capacity rests upon him. See further under AGE; CONSENT.

The parents are entitled to the custody of the child during infancy, and they are also entitled to earnings until this right is voluntarily renounced by them, when the infant is said to be emancipated. As between the father and the mother, the father was at common law entitled to the custody of the child. The modern tendency of the courts is to accord the custody in case of dispute to the parent best able and qualified to care for the child.

In many States male infants of eighteen years or over may be executors and administrators.

Infants are not permitted to sue in their own name and right in either courts of law or equity.

The action must be brought by the infant's near friend (*prochain ami*) or guardian *ad litem*, who is a relative, a friend, or other proper person permitted by the court to prosecute the action in the infant's behalf. Courts of equity early constituted themselves the especial protectors of infants, giving them relief in various ways, particularly by appointing guardians over their person and property. The care of an infant's property by guardian is now generally regulated by statute (see GUARDIAN), the effect of which is to place the infant's property in the possession of a guardian appointed by the court, who is required to invest and care for the property as a trustee for the infant. See CONTRACT; DOMESTIC RELATIONS; and consult the authorities there referred to.

INFANTE, ên-fän'tâ (Sp., Port., infant). The title given in Spain and Portugal to the princes of the royal family, with the exception of the heir apparent, the corresponding title of Infanta being given to the princesses. Since the fourteenth century the heir apparent to the throne in Spain has been styled Prince of Asturias, and the heir apparent in Portugal, until the separation of Brazil from the mother country, bore the title of Prince of Brazil.

INFANTE, JOSÉ MIGUEL (1778-1844). A South American statesman, born in Santiago de Chile. He played a prominent part in the Revolution of 1810, was President of the Government Junta in Chile after 1814, and went on a diplomatic mission to the Argentine State in 1817. His patriotism was unselfish; he came out against arbitrary authority, and refused office when he thought his country in no need of his services. In 1843 he declined the position of Chief Justice of the Supreme Court, offered him as a mark of the nation's gratitude. He contributed greatly toward the emancipation of slaves in Chile and took active part in the establishment of the common-school system.

INFANTICIDE. The killing of an infant or newly born child; often in a broader sense, the killing of an infant, whether entirely born, or in the act of being born, or of the matured fœtus in the womb.

As an institution or customary practice infanticide has existed in most savage or semi-civilized races, and still survives in many; as an occasional or abnormal act it has existed in all times and among all peoples.

Some authorities, as McLennan, have claimed that the custom has been practically universal among primitive races; but the researches of other investigators, as Spencer and Westermarck, have shown it to have been much less widespread than this. Infanticide as practiced among early peoples is to be traced ultimately to conditions of hardship attached to the bringing up of children. Thus among the Abipones, where the women often practice infanticide, the boy was generally sacrificed; for when a son grew up it was necessary to buy a wife for him, while a grown-up daughter would always demand her price. But this hardship more usually attaches to the bringing up of female children, and it is therefore the females who are usually killed rather than the males. This is said to be especially true of those tribes who are surrounded by enemies, and who are forced by their manner of living to lead a migratory life. The practice of killing female children among these people often left the primitive hordes with very few young women, so that they were forced to prey upon each other for their wives. This by some has been considered to account for the rise and growth of exogamy; while others have (with less reason) attributed infanticide to the custom of exogamy. In Africa, where the warm climate and the abundance of tropical fruits make the conditions of existence easy, there are no well-authenticated cases of the habit of destroying new-born children.

The natives of two-thirds of the South Sea Islands practice infanticide probably more extensively than any other peoples known to history. The chief reason is probably the fact that the islands are of very limited extent, and are as thickly populated as they could be and support life by the natural products of the soil. In parts of Australia it is said that the *mother* destroyed all but two boys and one girl, while in Samoa and other Pacific Islands and in some parts of Australia the custom is unknown. Generally speaking, therefore, infanticide is most commonly observed among races living where the struggle for subsistence is most severe, or where custom imposes the most burdens upon those rearing children. The best-known instances of infanticide are those which existed in various forms through India, but which are now mostly suppressed in the territory under the control of the British Government by a system of compulsory reporting of births and deaths and of police supervision in districts suspected of it. It was practiced among certain of the tribes of lower caste, as well as among the Rajputs, although forbidden by the Koran and the Vedas. Among some tribes it was due to hardship attaching to the procuring of the means of subsistence, and among others its origin, or the persistence of it, was due to artificial hardships attendant upon child-rearing, as among the Rajputs, with whom it was dishonorable for a girl to remain unmarried, and the necessary expenses of her marriage were a ruinous burden upon the parents. A similar condition obtains among certain of the American Indians of the Northwest.

When infanticide has become established as a custom among a savage race, its practice, like all practices connected with birth or marriage, frequently assumes a sacrificial or religious import, and it is by some considered to be the explanation of the origin of the practice of sacrificing children to the gods, the custom of exogamy as above noted, and other rites or ceremonies. So, also the method of killing becomes, in many cases, a matter of custom, as by casting into the Ganges in some parts of India (whence the reverence paid to the alligator, which fed upon the children), or poisoning with opium or datura smeared upon the mother's breast, or by sacrifice to some god. Where the practice survives as a sacrifice it is usually the boy child that is killed. Any change which makes child-rearing less of a burden tends to decrease or do away with infanticide. It may, however, still be permitted or survive as a means of disposing of the weak or defective, as was the case in ancient Greece, where the killing of weak children was enjoined in the ideal systems of Aristotle and Plato, and by the actual laws of Lycurgus and Solon.

Infanticide, as it exists among peoples whose laws or customs forbid its practice, is due to special abnormal causes, as extreme destitution, insanity, abnormal antipathy to the child, fear of disgrace, etc. The usual cause among modern civilized nations is the desire on the part of the mother to escape the shame of illicit child-bearing, or to escape the burden of caring for an illegitimate child. (See ILLEGITIMACY.) In some cases, as in France, laws have been passed which aid the mother in supporting her illegitimate child without exposure or undue burden; and these laws are said to have reduced the proportionate number of infanticides, but to have increased the number of cases of illegitimacy.

The laws of all modern civilized nations treat infanticide as a crime, but they vary too greatly to admit of being specifically stated here. Some of them treat it as a special crime of less gravity than murder, restricting infanticide to the killing of an infant which is newly born (within the time limited by the law); and others make no distinction between infanticide and murder, the question as to when the infant was born being immaterial. The latter is the case at the common law of England and the United States, where the unlawful killing of a fully born child (see BIRTH) is murder, as distinguished from the killing of an unborn child, which is abortion. See ABORTION.

Consult, for the full discussion of the law as to infanticide and much of the general history, the works referred to under MEDICAL JURISPRUDENCE, such as Taylor, *Principles and Practice of Medical Jurisprudence* (3d ed., Philadelphia, 1883); *Manual of Medical Jurisprudence* (12th Amer. ed., Philadelphia, 1897); Wharton and Stillé, *Medical Jurisprudence* (4th Amer. ed., Philadelphia, 1884). For the other aspects of infanticide, consult: Lubbock, *Prehistoric Time* (5th ed., London, 1889); *The Origin of Civilization, and the Primitive Condition of Man* (3d ed., London, 1874); Lecky, *A History of European Morals* (3d ed., London, 1877); Westermarck, *The History of Marriage* (New York, 1891); McLennan, *Studies in Ancient History, etc.* (London, 1876); and, for the history of the subject in India, consult Browne, *Infanticide: Its Origin, Progress, and Suppression* (London, 1857).

INFANT PHENOMENON, THE. Ninetta Crummles, a character in Dickens's *Nicholas Nickleby*, the daughter of Vincent Crummles, the theatrical manager.

INFANTRY (Fr. *infanterie*, from Sp. *infantería*, from *infante*, young person, foot-soldier, from Lat. *infans*, infant, from *in-*, not + *fari*, Gk. *φῆναι*, *phēnai*, to speak, Skt. *bhā*, to shine). A term applied to an organized body of men, trained for rapid evolutions, and to fight always on foot. It thus stands in contradistinction to the cavalry, which is primarily for mounted service in charges on the field of action and in covering the flanks of an army, or as a screen or curtain to conceal movements, and as a corps of observation; the cavalry is also, especially in the United States service, required at times to operate dismounted. In feudal times the lords were considered 'the chivalry,' at least by themselves, and they ceased to regard the infantry, which was composed of the poorer people, badly equipped and armed, in the same high esteem accorded to it in the earlier wars. Nevertheless the English infantry armed with the longbow was recognized as a dangerous antagonist, and the crossbow, though inferior in accuracy and quickness, was not to be despised. As regards other weapons, the spear-heads of the Crusaders were barbed and so were the arrows used at Crécy and elsewhere, the object being to make it impossible to extract them without laceration of the flesh. The sarbacane, a long, hollow tube, was in use for shoooting poisoned arrows at the enemy. The spears were of diverse forms, known as glaives, rocones, partisans, cisarmes, spontoons, and halberds, all of which were in use by the infantry. With such weapons and equipped with pilos or helmet, manteau d'armes, a shoulder-protector, cuirass, loinguard, spear, war hammer and sword, buckler or rondache (shield), mobility of action was not possible.

The armies of the ancient Greeks were composed of infantry, and in the Roman armies cavalry played but a very subordinate part. It was not till the time of the feudal system that cavalry became the more important force. The decay of feudalism affected the cavalry as the principal fighting force in armies. The victories by the foot-soldiers of the liberty-loving Swiss mountaineers over the Austrians at Morgarten (1315), Sempach (1386), and Näfels (1388) increased the esteem in which foot-soldiers were generally held, and, as will be shown further on, centuries have established the fact that this arm of the service is the most essential and most important factor in war.

The Grecian order of battle, termed the phalanx, was eight to sixteen ranks in depth, either forming a triangular-shaped wedge, with the apex to the enemy, or a solid rectangle arranged in subdivisions, each equivalent to a company of 120 men, with distances between them equal to their front. The advantage of this massive formation was found in weight of impact as an attacking force, irresistible from its momentum and in its great resisting power in defense. The Romans first encountered the famous phalanx when defeated by Pyrrhus at the battle of Heraclea (B.C. 280). The phalanx, as a whole, often comprised 10,000 to 20,000 men when in order of battle. These masses were not easily handled, and were practically without mobility, unable to work over rough ground or execute changes of front, or flanking manœuvres with necessary rapidity of action.

The Greek infantryman was equipped with shield, helmet, breastplate, and greaves (metal leggings), sword, battle-axe, and barbed spears or javelins which were hurled with great force in close fighting. The bow and arrow were used in skirmishing well in advance of the main body, and before the conflict reached the stage of the hand-to-hand combat. The great strength of the Roman legion, numbering 4500 men, was principally in the infantry. It was divided into 1200 *hastati* (spearmen), 1200 *principes* (veterans), 1200 *velites* (skirmishers), 600 *pilani* (veteran reserves), and a small cavalry contingent numbering 300 *equites*. Later the customary formation of the phalanx was somewhat improved by line or legionary formations in three lines, but still retaining the great depth of ten men. This plan made possible extension of lines and outflanking the enemy's front or rapid massive formations to meet concentrated onslaught. The loose formation, with intervals of a pace or more between files, was similar to the *extended order* of modern tactics, and in other features connected with the attack, support, reserves, etc., we have in our modern system quite closely followed their ideas, omitting the heavy lines. The front rank of the infantry was frequently armed with spears 21 to 24 feet in length, or lances 18 feet in length; the *pilum*, an iron-pointed spear weighing some 12 pounds, was thrown at close range, and this attack followed by a rush and mêlée with the short, stout, two-edged sword. The introduction of gunpowder in the fourteenth century and the invention of the hand-gun during the fifteenth century contributed to hasten the downfall of feudalism by rendering the infantry soldier equal to the armor-clad knight. To Prince Maurice of Nassau (1567-1625) is attributed the sagacious plan of arming half of his infantry with firearms and improving the butt-end of the arquebus, so that it could be handled more readily and placed against the chest. Nevertheless, still following the old fashions, he kept his infantry in ten ranks.

Firearms in improved forms for the infantry gradually came into general use, but for defensive purposes more than half of the infantry were still armed with the pike to keep off the cavalry, the firearm as yet not having the bayonet. In 1638, at Wittenweiler, the musketeers of the Duke of Weimar were able to fire only seven times between noon and 8 P.M. The further use of firearms led to the gradual reduction of armor and depth of formations of the infantry. More radical changes were, however, made during the seventeenth century (1630) by Gustavus Adolphus, King of Sweden. Perhaps the most vital reform instituted arose from greatly improved discipline and the improvement in the equipments, which aimed to lessen the weight of the musket and increase the effectiveness of the infantry. The use of cartridges enabled a soldier to fire at least twice as rapidly as was possible when powder, primer, and bullets were carried in separate pouches. Gustavus Adolphus continued the heavy phalanx formation with some modification, his infantry forming six ranks deep, and when under fire deployed to form three ranks, following the old Roman method of the second line replacing the losses of the first line; the infantry were in line formations, subdivisions certain distances apart. The musketeers numbered nearly three-fourths of Gustavus Adolphus's infantry. The Swedish order of battle was thus formed on the memorable field of Lützen (1632). The Germans, in this battle, adhered to the heavy and deep phalanx formation. Under Charles II. (1660-85) the foot regiments were armed either with pikes or matchlocks or firelocks, and each soldier also carried a sword; they were later equipped with the hand-grenade, whence the name 'Grenadier Guards,' the equipment being modernized while the name has been retained.

Few tactical changes followed the death of Gustavus Adolphus, until Frederick the Great (1740-86) revived interest both in arms and organization by many reforms and corrections of military errors. The infantry, his main strength and dependence, was formed in three ranks, enabling every man to fire. The army was arranged in two lines, omitting, however, all skirmishers and reserves. The limited range of their firearms brought the troops into closer personal contact than occurs nowadays. The victories of Frederick the Great in the War of the Austrian Succession (1740-48) and the Seven Years' War (1756-63) placed Prussia preëminent among the military powers of Europe. The heavy formations so long continued, now gave way as cannon were brought into use and great masses of artillery concentrated to crush the enemy. The column formation, practically the same thing except that the lines were composed of two or three files, with lessened front and greater number of lines, continued down to very recent years; and to-day the formation in mass, either line or column, has been abandoned for the extended-order system.

Infantry constitutes the principal tactical and administrative body of the army and the basic foundation for the proportion of all other arms, and it can be more rapidly trained and mobilized than either cavalry or artillery. It is in the infantry that the principle of expansion finds its widest application. In determining the organization of the line of the army it is given the greatest preponderance. In the armies of Great Britain the proportion is: infantry, 141,602; all other arms, cavalry, artillery, engineers, etc., 87,000; and in the Indian Army—infantry, 109,000; all other arms, 23,000. The proportionate loss of the several important arms of the service during the Franco-Prussian War was given, for the German Army, as: infantry, 17.6 per cent.; cavalry, 6.3 per cent.; artillery, 6.5 per cent.

INFANTRY BATTLE FORMATIONS. Tactical dispositions have materially changed from time to time as rifled guns and breech-loaders have developed rapidity and precision of fire, while the flatter trajectory of a projectile, moving almost horizontally instead of with high curvature, increases the danger space to within 2000 yards' range. The decisive firing usually begins at about 600 yards. The plan now in general use for infantry—alternate rushes by sections, platoons, or companies—has been found best adapted to attack, such rushes usually being limited to fifty yards, but under war conditions governed by strength and accuracy of the enemy's fire and the cover furnished by the terrain, and exceeding this only when the ground offers more favorable position. The men between such rushes kneel, lie down, or get under cover of some suitable object, this protection being considered of more importance than precise distance or regularity of alignment. This is the system termed 'extended order,' or perhaps better expressed as individual or dispersed order; it is a regulated disorder. The term 'loose order' should not, however, be used, as leading to possible misconstruction; it merely means the no longer close formation, leaving to each soldier some latitude of action. Each man has intervals from his next file of 35 or 45 inches in single ranks, supported by similar lines of supports and reserves.

This system requires thorough discipline and alertness in observing surrounding conditions. The spaces between ranks and lines of supports are necessarily elastic, and permit of freer individual action, with the least possible losses in advancing to the attack in face of a murderous fire from the repeating rifles. The zone of the infantry fire commences with unaimed firing at extreme range of 2000 yards; the aimed fire beginning to tell at 1000 yards, and at mid-range, 600 to 300 yards, the infantry lines advancing by alternate rushes, the fire should be very effective; rapid fire is used at ranges of less than 300 yards. The unaimed fire causes many losses, but the heavy losses which check advancing troops are caused by the aimed fire. (See TACTICS, MILITARY.) The extended order had its inception in the War of the Revolution, and has of late years become general in application in the United States and all European armies.

In the army of the United States the service is voluntary, and the term of enlistment is three years. The infantry organization consists of thirty regiments of twelve companies each, divided into three battalions. The enlisted force of two of these regiments, the Twenty-fourth and Twenty-fifth, are colored men. Peace strength of companies, 3 officers and 65 rank and file, which may be increased by the President by addition of 85 enlisted men per company. A regiment in Porto Rico and battalions in the Philippines not exceeding 12,000 men, of native troops, with United States officers, constitute a probationary or provisional force. The National Guards of the various States, in which enlistment is also voluntary, represent all classes, and are generally well drilled and equipped, forming an excellent line of reserves. Congress determines upon the strength of the army, and has subjected it to radical augmentation and similar reduction. At the beginning of the Civil War the regular infantry numbered about 8000 men; during that war, lasting from 1861 to 1865, the army toward the close, including regulars and volunteers of all arms, aggregated over 1,000,000 soldiers. In 1866, 45 regiments of regulars (infantry) were organized, and in 1869 reduced to 25 regiments. Appointments of officers are made: (1) from graduates of the Military Academy; (2) from the ranks after two years' service, subject to rigid educational examination and antecedents; (3) from civil life, if vacancies still exist. *Arms.*—Krag-Jörgensen and improved Springfield magazine, modified calibre .30; knife-bayonet, 10.32 pounds; bullet, cupro-nickeled steel, 220 grains; Peyton powder, 43 grains; weight of cartridge loaded, 413 grains. *Equipment.*—Knapsack with clothing (though seldom carried by the soldier), haversack for rations with meat-can, knife, fork, and spoon; canteen of tin, felt covered, for water; blanket rolled in piece of shelter-tent, and carried across the shoulder; cartridges, 80, in woven waist-belt, and usually 70 additional in pockets of coat. *The March.*—Length of pace 30 inches, 120 paces per minute: double time, length of pace 36 inches, 180 paces per minute; 15 to 20 miles per day. Statistics regarding the armies of foreign countries may be found under ARMIES.

Consult: *The United States Infantry Drill Regulations* (New York, 1891); Jerram, *Armies of the World* (London, 1899); Powell, *Customs of the Service* (Kansas City, 1902); and the various publications of the War Department, including *Colonial Army Systems* (Washington, 1901); *Notes on Organization* (Washington, 1896); *Reports of the Secretary of War* (Washington, annually). Reference should be made to the article on TACTICS, MILITARY, for a full discussion of infantry tactics, and also to the article ARMY ORGANIZATION. The function of infantry in advance guard, outpost, and other work will be found discussed under the appropriate titles. See also the article ARMIES.

INFANTS, FEEDING OF. The proper food for an infant is naturally its mother's milk. If for any reason, such as absence of milk in the mother's breasts, disease or death of the mother, it becomes necessary to look elsewhere for nourishment, a wet nurse should be procured for the child. If this is impossible or impracticable, a substitute must be found for breast-milk. Cow's milk is the most available substitute. Average human milk contains from 3.5 to 4 per cent. of fat, 1.5 per cent. of proteids, and 7 per cent. of sugar. Average cow's milk has 4 per cent. of fat, 4 per cent. of proteids, and 4 per cent. of sugar, in round numbers. Cow's milk in which the relative proportions of these ingredients is so changed that they correspond in amount to the same ingredients of human milk is called 'modified milk.' Various formulæ are prepared for various ages of bottle-fed children, and these must be altered to suit the digestive powers of each individual infant. For the first three days after birth the colostrum in the mother's breasts, if available, is drawn by the child, and besides this a little sugar-water of ½ per cent. strength is given. From the fourth day a weak milk mixture should be given, containing 1 per cent. of fat, 0.4 of proteid, and 4.5 of sugar. On the tenth day this is increased to 1.5 per cent. of fat, 0.7 of proteid, and 5 of sugar. A gradual increase in the strength of the milk mixture is made till when the child is six months old it will receive 3 to 3.5 per cent. of fat, 1 to 1.5 of proteid, and 7 of sugar. The weight of the child is ascertained every two or three days, and its fæcal passages are inspected daily for evidences of indigestion, and hence reasons for varying the ingredients of the milk mixture. At first, one pint of the modified milk is divided accurately into 10 parts, and one part is given to the child every two hours except during the middle of the night. Later, a larger supply is necessary, and the intervals between the feedings are lengthened to three hours.

In most cities the average milk in the shops is so unreliable that it must be sterilized to be safe, though the process renders it less digestible. Sterilization of milk is done by heating it to 212° F. and keeping it at this temperature for half an hour. Pasteurized milk is heated to 167° F. for half an hour. During hot weather it is important that all milk fed to infants be treated by either of these processes. In certain conditions of indigestion it may be necessary to rest the stomach from its attempt to digest the proteid, and barley water is substituted for milk. Barley water, made of the strength of two teaspoonfuls of barley to the pint of water, contains about 0.7 per cent. of fat, 3 of proteid, and 2 of carbohydrates. Overfed children are always unhealthy, and suffer from colic, diarrhœa, and vomiting. In such a case barley water or simple water may be the best food for twenty-four hours, and a specially modified milk adapted to its use thereafter. Many prepared infant foods are on the market. Some suit certain children; some cause distressing indigestion, and endanger the lives of other children. The physician or experienced child's nurse must be the judge of the use of such foods. Consult: Jacobi, *Infant Diet* (3d ed., New York, 1875); Holt, *Diseases* *of Infancy and Childhood* (New York, 1900); Fischer, *Infant Feeding in Health and in Disease* (Philadelphia, 1901). See Food; Milk.

INFANT SCHOOL. An educational, or rather charitable institution, which sprang up during the latter part of the eighteenth and early part of the nineteenth century, at first on the Continent, and later in Great Britain, and in the United States. The object was to care for neglected children of early age, especially those of factory women, who were left with few physical comforts and no moral oversight. Such children were gathered together during the day, and, in order to render their care less irksome, they were taught to march, to perform simple gymnastic exercises, to sing simple songs, to repeat the multiplication tables, names of the days of the week, and similar things, and in later years at some places to read and sew. The educational purpose was purely secondary, at least until the influence of the Pestalozzian ideas prevailed in the second quarter of the nineteenth century. There is no historic connection with the origin of the kindergarten (q.v.).

The first infant school was founded in 1780 by Oberlin (q.v.), the pastor of Walbach in France. He appointed women in his own parish to assemble the children between the ages of two and six and to interest them, by conversation, in pictures, maps, sewing, etc. In Great Britain the first infant school was due to Robert Owen, opened in connection with his communistic establishment at Lanark, Scotland. In 1827 the Glasgow Normal Seminary was founded by David Stowe to carry out this idea of the infant school. In 1819 a similar school was established in London in charge of Wilderspin, under the patronage of such men as James Mill, Zachary Macaulay, and Lord Brougham. Other schools soon followed, and in 1836 this movement was unified in the formation of the "Home and Colonial Infant School Society," which contributed more than any other instrumentality to the extension of the infant school by training teachers and instituting model schools. Up to this time the movement had succeeded by keeping distinct the processes of training and instruction, and by not attempting any educational work of the latter character. The society was the outgrowth of the influence of the Mayos, brother and sister, one of whom had been a student of Pestalozzi at Yverdon. Thereafter the work of the infant school was to include instruction after the Pestalozzian methods. Under the educational grants of Parliament, many infant schools were established, and especially since the Royal Commission of 1858-61 they may be considered as a component part of the British school system. In Continental Europe it is the kindergarten built upon Froebelian lines that is very generally established. In France, however, the public *crèche*, which is for children of two and three years of age, is very general. The *école enfantine* for children of four and five years of age is a kindergarten. Such schools, as distinct parts of school systems, will be described under the title National Education, Systems of. The term infant school is ordinarily restricted to the type of charity-grant schools of England. In the United States the first infant school was established in Boston, in 1826, under A. B. Alcott. While this school was a marked success, and there were numerous similar attempts in various other American cities, there was no great demand for such institutions in a population not primarily urban and engaged in manufacture. Similar needs were met by the Sunday-school, and, before there arose any great need for the charity infant school, by elementary public schools with free tuition.

Consult: Gill, *Systems of Education* (Boston, 1887); article on "Young Children, Education of," in Sonnenschein's *Cyclopædia of Education* (London, 1889); Wilderspin, *Infant System* (London, 1840); id., *Education of the Young* (London, 1840); Gregory, *Elementary Education* (London, 1895). See, also, Kindergarten; National Education, Systems of.

INFECTION (Lat. *infectio*, a dyeing, from *inficere*, to dye, mix, from *in*, in + *facere*, to make). The condition produced by the entrance into and multiplication within the body of pathogenic micro-organisms, whether bacteria or protozoa. Every infectious disease has its infectious element. This element may be propagated by contagion from particles carried by the air, as where the virus of the disease clings to scales of epidermis in scarlet fever or smallpox; it may be propagated by contagion from fæcal matter, in which the virus is discharged, as in typhoid fever or cholera. Whether micro-organisms can be transmitted after elimination in the breath is yet uncertain. Probably they can be detached from mucous surfaces by the currents of the breath, freed by expulsive coughing. The mode of elimination of the virus from the body decides whether the disease be contagious or not. The significance of the question of the reproduction of infectious micro-organisms outside of the body is great. Drinking-water may be contaminated with typhoid-fever germs; milk may be contaminated with pus germs. The virus of some diseases may be carried by the air, as in the case of pulverized sputa of tubercular patients. Probably the virus of yellow fever may be conveyed through the atmosphere. Actual contact with the agents of infection, however, constitutes the chief means of infection. Predisposition plays a secondary part as a factor in such causation. Race influences susceptibility to disease. The size of the dosage of bacteria is important, a large injection producing disease where immunity to small doses exists.

Auto-infection occurs where, in a parturient woman, for example, septicæmia occurs as a result of infection of the uterus with pathogenic germs which have gained entrance into the vagina. See Immunity; Contagion.

INFECTIOUS DISEASE. A disease which is communicated by means of bacteria or protozoa which enter the body. A contagious disease is propagated by means of virus carried from person to person upon mucus from the mouth or respiratory tract, upon scales from the skin, etc. Contagious diseases include measles, smallpox, scarlet fever, tuberculosis, etc. On the other hand, typhoid fever and cholera are not contagious. They are transmitted through the use of drinking-water or food containing the germs of each disease. All the diseases mentioned are infectious, including those of the contagious class. See Infection.

INFEFTMENT AND SASINE. A Scotch law term, corrupted from the 'feoffment' and 'seisin' of the feudal law of England, and employed to denote the formal act whereby the title to land was conveyed. It consisted in the symbolical transfer of possession by handing over a twig or clod of earth in token of the land conveyed. The instrument of sasine was the notarial instrument embodying the fact of infeftment. But now the necessity of a separate formality is unnecessary, it being sufficient to register a conveyance in the register of sasines in Scotland. In England there is no similar register for deeds, and the title is complete when the conveyance is executed and delivered to the purchaser. In Scotland an *infeftment in security* is a temporary infeftment to secure payment of some debt, and an *infeftment of relief* is a similar security to relieve a surety or bondsman.

INFEOFFMENT, in-fĕf′ment. See Feoffment.

INFERENCE (ML. *inferentia*, inference, from Lat. *inferre*, to infer, from *in*, in + *ferre*, to bear). In logic, the process of so coördinating and systematizing one's knowledge that new knowledge is thereby gained. Inference may be induction or deduction. See Induction; Deduction.

INFER′NO, The. See Dante Alighieri.

INFINITE (Lat. *infinitus*, boundless, from *in-*, not + *finitus*, bounded, from *finire*, to bound, from *finis*, bound, from *findere*, to cleave; connected with Skt. *bhid*, to split, Goth. *beitan*, OHG. *bizzan*, Ger. *beissen*, AS. *bītan*, Eng. *bite*). In philosophy, a term used in various senses, while at the same time there has been much discussion as to the reality of any object denoted by the term. The extended objects of our ordinary perception do not occupy all the span of our field of vision. They have outlines which mark off their area from circumjacent space. And so with temporal magnitudes. Objects last for a longer or shorter period, before which they were not experienced and after which they are no longer experienced. Their duration is finite, because set off by limits—i.e. by their initial and final moments. Intensive magnitudes also are conceived by analogy as finite. Thus I hear a sound which is followed by a louder one. In this case the less is not marked off from the greater by limits. It is not a part of the greater, although it may be that the space traversed by the vibrations of the air which cause the softer sound is part of the space traversed by the vibrations which cause the louder sound. Whatever may be the reason that makes us use in the case of these so-called intensive magnitudes the same terminology (e.g. greater and less), there is no doubt that we do so speak of a 'finite' intensity whenever we conceive of a greater intensity as possible, although here the less is not included in the greater, and therefore it is not marked off or limited within the compass of the greater. It is important to keep this distinction in mind, for corresponding to this distinction we have two senses at least of the word 'finite,' and of course as many possible senses of the word 'infinite.' (1) The infinite is that which is not an extended or enduring part of some larger extension or duration. Now, if this be the meaning of infinite, we may say there are possible two kinds of infinites—(a) those which, though spatial or temporal, are not parts of larger spatial and temporal wholes, and (b) those which are not spatial or temporal at all. The only possible candidates for inclusion under (a) are 'infinite space,' and 'infinite time,' and 'infinite number.' Under (b) would fall all intensive qualities. For instance, the loudness of any auditory sensation would be infinite in this sense, although the duration of the sensation and the distance at which the sound is heard are both finite.

(2) The infinite is that which, having intensity, exceeds in intensity everything else. An infinite sound in this sense would be a sound which had a loudness surpassing that of all other actual or possible sounds. Infinite heat would be a heat-temperature sensation surpassing in intensity all other actual or possible sensations of like sort; and so with the affections and the emotions. Now, with given conditions—i.e. a certain sentient and affective organism in a given state—there is something that corresponds to this definition. A sound of a certain definite degree of loudness is the loudest sound a particular sentient being can hear. A greater wavelength of air could not be heard. But no one seems disposed to call such a sound one of infinite loudness. Again, we can 'bear' pain up to a certain point, differing in different individuals. Beyond that point we become insensible.

(3) Still another sense of the infinite is the unconditioned. Everything that appears in experience is conditioned: it is what it is because other things are what they are; but in contrast to these conditioned realities some philosophers of almost all ages have believed in a reality lying behind experience and having a self-subsistent character not defined by any qualities that appear in experience. Herbert Spencer's (q.v.) unknowable is an infinite of this character. Such an infinite is sometimes called an abstract infinite—abstract because without any definite positive quality, and because considered to have its essential being in separation from the concrete world we know.

(4) Still another meaning of the infinite is the unattainable limit of an unending process of construction. This is well illustrated in the view taken by some idealists that time and space are constructed in the act of thinking them. This construction is conceived, not as complete, but as having no limit to the possibility of its continuance. Infinite space is thus the unattainable result of the unending process of constructing space. It is the fact that you can never come to the end of possible space construction. One species of the mathematical infinite seems to fall under this head. Thus, in the improper fraction $\frac{1}{x}$, as the value of x decreases by one-half the value of the fraction is doubled. If the decrease is continued without end, the fraction is conceived as approaching infinity. Here again infinity is the unattainable result of the unending process of halving the denominator. This infinite differs from the infinite of space and time considered under (a) in that space and time are often regarded as existing apart from any construction on our part, while the former is considered simply as the algebraic expression of the fact that our construction can continue without end. It is not considered as an actual reality, but as an unattainable ideal, while infinite space and infinite time are by some realists considered to be actual facts.

(5) Infinite in another sense is any member of an all-inclusive system of reciprocally determining members. Thus, according to Hegel, all reality is infinite. Hegel justifies the use of the term by pointing out that in a true system any member in being determined by the other members is really self-determined, because its systematic relation to the other members is an integral constituent of its own nature. These other members exercise no foreign compulsion upon it to make it what it is. They determine it only because it is part of its own being to be so determined. They do not set limits to it which it may not pass, but they give it opportunity to be itself. To take one of the apparently most refractory instances, the billiard-ball is not infinite in sense 1*a*, because though spatial its place is only a part of a larger space from which it is marked off by definite boundaries. But the ball is something more than so much space. It is an object that undergoes various changes under certain conditions—e.g. when struck it rolls. This dependence of its changes upon the action of other objects is often considered another evidence of its finitude. But it must be remembered that it is only because it is the nature of the ball to roll when struck that it rolls at all. In rolling it does not succumb to external force, but it acts its own part. Though determined, it is self-determined. Though compelled, it is free. This free, self-determined nature of every member of any free system is what Hegel calls infinite. He considers the term infinite appropriate because the systematic conditions which determine the ball's action do not limit it in the sense of repressing its spontaneous tendency to act out its own nature. They simply give it a chance to show one side of its nature in a certain definite movement. There is no reason why the term infinite should not be employed in this case. But there is every reason to remember that this sort of infinitude is thoroughly compatible with finitude in another sense—e.g. spatial. When Hegel says that the finite is essentially infinite, he means that that which is conditioned (*bestimmt*) is conditioned because it is its very nature to act in response to these conditions; that condition is not restraint (*Schranke*) of an inherent tendency by an external limit (*Grenze*). A reader in philosophy must keep himself always on the alert to detect the various meanings of the word infinite, and then he will be able to understand many paradoxes that at first appear to be illogical contradictions. Whether the infinite really exists depends on the kind of infinite you mean. The existence of infinite 1*a* is discussed elsewhere (see NUMBER; SPACE; TIME); infinites 1*b*. 2 in at least certain cases, and 5 are unquestionable. Infinite 3 is, if it does exist, unknowable, and there is not the slightest reason to assert its existence. Infinite 4 does not exist at any particular time from the very nature of the case, because it is an unattainable ideal. The infinite process is real at least in the case of time in the sense that the flow of time never ceases; but at no moment has it completed its unending course, and in this sense infinite time does not now exist, nor ever has existed, nor ever will. But when the present tense is used, not specifically, but universally, it is then true that there is infinite time. Any further treatment of the question of infinity would be out of place here.

Consult: Royce, *The World and the Individual*, vol. i., supplementary essay (New York, 1900); Bradley, *Appearance and Reality* (2d ed., London, 1897); Couturat, *De l'infini mathématique* (Paris, 1896); Bosanquet, *Logic* (Oxford, 1888); Bolzano, *Paradoxien des Unendlichen* (Leipzig, 1851); Hegel, *Wissenschaft der Logik* (Berlin, 1841); J. Cohn, *Geschichte des Unendlichkeitsproblems im abendländischen Denken bis Kant* (Leipzig, 1896).

INFINITE SERIES. See SERIES.

INFINITY AND THE INFINITESIMAL (Lat. *infinitas*, from *infinitus*, boundless). A number conceived to be greater than any assignable number, however great, is called an infinite number. The symbol ∞, meaning indefinitely great, cannot be used in operations as a finite number; e.g. $\infty - \infty$ is not necessarily zero, and $\frac{\infty}{\infty}$ is not necessarily 1. A number that varies and becomes and remains smaller in absolute value than any assignable number, however small, is called an infinitesimal number. The use of the symbol 0 is also limited; e.g. $\frac{0}{0}$ is not necessarily 1. (See FRACTIONS.) In modern geometry the notion of infinite points and infinite lines has led to great generalization, and supplied the condition for continuity (q.v.) of many relations; e.g. for the statement, "Two coplanar lines are concurrent or parallel," may be substituted, "Two co-planar lines are concurrent in a finite or an infinite point." In modern analysis the infinitesimal has played an important rôle. From the time of Kepler mathematicians have struggled with the infinitesimal, especially as employed in the differential calculus, and some, notably Lagrange, have tried to avoid its use entirely. But through the efforts of Legendre, Gauss, Carnot, and especially Cauchy, the meaning of the propositions concerning infinitesimals has been established, and a safe foundation for the differential calculus has been laid. See the article CALCULUS.

INFIRMARY. See HOSPITAL; DISPENSARY.

INFLAMMATION (Lat. *inflammatio*, from *inflammare*, to set on fire, from *in*, in + *flamma*, flame; connected with *flagrare*, Gk. *φλέγειν*, *phlegein*, to blaze, Skt. *bhraj*, to be bright). A morbid condition characterized by altered function of the elements of the tissue involved, changes in circulation, derangement of local nutrition, and generally an exudation infiltrating the tissues affected. It is a process of extreme complexity, presenting variations depending upon the exciting cause and upon the kind of tissue in which it occurs. It is therefore impossible to define it satisfactorily. The most obvious symptoms or phenomena of inflammation, when it attacks an external or visible part, are pain, redness, heat, and swelling, together with altered function. The general characters of the process will be best understood by an assumed case. If a healthy man has a splinter of wood or any other foreign body imbedded in any fleshy part, he begins to experience pain at the part, and this is soon succeeded by redness of the skin, a firm and extremely tender swelling at and around the spot, and a sense of abnormal heat. These purely local symptoms are succeeded, if the inflammation reaches a certain degree of intensity, by a general derangement of the vascular and nervous systems, to which various names, such as constitutional disturbance, symptomatic or inflammatory fever, pyrexia, etc., have been applied. If the foreign body is extracted, the probability is that all these symptoms will gradually abate, until the part at length regains its natural appearance and sensations. If, however, the cause of irritation is not removed, or if the intensity of the morbid process exceed a certain point, the following phenomena occur: The swelling assumes a more projecting or pointed form, the part becomes softer, and the skin at its centre, which is usually the most projecting part, becomes whiter. There is a sensation of throbbing pain, and if the skin be not divided with a knife it finally breaks, and a yellow, cream-like fluid, known as pus (q.v.), escapes, after which the symptoms rapidly abate. This process is known as *suppuration.*

If the original injury was very severe and the inflammation intense, there may be actual death of the part affected. In that case, the red color of the skin becomes purple or greenish-black, the pain ceases, and the part becomes dead and putrid. This is *mortification.* Under favorable circumstances this dead part, which is called a ***slough***, spontaneously separates from the adjacent living parts by a process known as ulceration, and the cavity which is thus formed gradually fills up and heals.

The ***pain*** may vary from mere discomfort to intense agony. There is usually most pain in those parts in which the tension produced by the swelling is the greatest, as under the periosteum, or beneath serous or fibrous membranes, etc. The pain occurring in inflammation is always aggravated by pressure, and by this means the physician can often distinguish between inflammatory and non-inflammatory disorders. The ***heat*** is seldom so much increased as the sensations of the patient would lead him to believe; it does not rise above the maximum heat of the blood in the interior of the body. This increase of heat depends upon the increased flow of arterial (or highly oxidized) blood to the part. The redness depends upon there being more blood than usual in the vessels of the affected part. The *swelling* depends in part upon the distention of the blood-vessels and upon the presence of various fluids, such as blood-serum and pus, in the tissue of the affected part.

For the study of the details of the inflammatory process and of the sequence of the changes which take place, it is most satisfactory to observe their progress in living tissues. If the mesentery of a frog whose muscular system has been paralyzed by curare be exposed to the air, this unaccustomed exposure starts inflammatory changes which can be observed under the microscope. There is first seen to be an increase in the rate of blood-flow through the capillaries; then the capillaries become somewhat dilated, and the blood-current becomes slower than normal. White blood-cells accumulate along the capillary walls, and at various points stop and attach themselves to the endothelial cells. If these white blood-cells be watched carefully, some of them may be seen to pass through the cement substance between the endothelial cells, and in this way pass out into the surrounding tissues. Some fluid is also seen to accumulate in the tissues, this fluid having evidently come from the fluid elements of the blood. Also red blood-cells in greater or less numbers may pass out of the vessels and be found in the surrounding tissues. These elements which leave the vessels and accumulate in the tissues during the inflammatory process are called 'exudates.' Their passage from the vessels into the tissues is known as 'exudation,' and this form of inflammation is often designated 'exudative inflammation.' The passage of the blood-corpuscles out into the tissues is called 'emigration' or 'diapedesis.' The serum of exudation contains the fibrin-forming elements of the blood, and so may lead to the formation of more or less fibrin in the tissues. The white blood-cells die and disintegrate (as they are especially prone to do in the presence of certain forms of bacteria), and form with the serum the thick, opaque, yellowish fluid that is known as 'pus,' the dead white blood-cells being the pus-cells. According to the way in which the elements of the exudate are associated and their relative proportion, the inflammation is known as serous, sero-fibrinous, sero-purulent, or purulent. When red cells are present in unusual numbers, the inflammation is designated 'hemorrhagic' inflammation. Such an inflammation as that described in the frog's mesentery may subside on the removal of the exciting cause. The serum is reabsorbed into the blood-vessels or lymphatics, the living blood-cells find their way back into the circulation, while those that are dead disintegrate and are absorbed. This process is known as 'resolution.' The character of an inflammation is largely modified by the nature of the tissue in which it occurs. Thus, when an inflammation occurs in dense fibrous tissue there is little chance for much distention, and the amount of exudate is limited by pressure. In tissues of looser texture the amount of exudate is apt to be larger. Mucous surfaces such as those lining the gastro-intestinal canal, the respiratory tract, and the genito-urinary tract react to the inflammatory process by at first a decrease in the amount of mucus, following which there is a marked increase of mucous secretion. This being in many cases the dominant feature, the inflammation is designated 'mucous' or 'catarrhal' inflammation. On serous surfaces such as the pleura, peritoneum, and pericardium, the sero-fibrinous exudate often leads to an agglutination of the opposing surfaces and the formation of adhesions. These adhesions bind the surfaces together and materially interfere with the natural free motion of the parts. Such a condition obtains in the so-called 'fibrinous' form of pleurisy. It is very common after inflammations of the pelvic organs in the female and after appendicitis. These adhesions may become organized by the development of blood-vessels in them, and so become converted into actual living tissue. In abdominal operations, extensive adhesions resulting from present or previous inflammatory processes and binding together the different viscera often offer the most difficult problem with which the surgeon is confronted. In inflammation of the iris the pupil may be rendered irregular or immovable, or may be even closed up by the formation of adhesions. In endocarditis, or inflammation of the membrane lining the heart, fibrin may be deposited in wart-like masses upon the valves, thus interfering with their functions and causing some of the worst forms of cardiac disease. See HEART, DISEASES OF.

During the progress of an inflammation, when minute particles of foreign substances are present in the tissues, or where there is decomposition of tissue elements, certain cells, derived probably mainly from the white blood-cells, make their appearance. These cells are known as 'phagocytes,' and have the power of taking up these particles of foreign matter or of disintegrated tissues, and either digesting them or carrying them off for deposit at other points.

The healing of wounds is, in a pathological sense, an inflammatory process. If after a clean-cut wound through tissues which have little vascularity, the sides of the wound be closely approximated, there is a little oozing of serum which sticks the cut surfaces together, some of the more injured cells die and disintegrate, while of those which remain intact some proliferate and cross the line of the wound, new connective-tissue fibres are formed, and the whole becomes firmly united. Such healing is known as healing by first intention. If the injury to the tissues is greater, or if the wound is left open, healing takes place in a manner essentially the same as just described, but somewhat more elaborate. Serum is poured out upon the surface of the wound and intermingled with the serum are red and white blood-cells. If bacteria are present pus is formed. After a varying length of time minute red points begin to stud the surface. These are known as granulations. Each granulation consists of loops of minute capillaries surrounded by newly formed connective-tissue cells. This tissue is called granulation tissue, and its new thin-walled vessels allow it to bleed easily. Over this granulation tissue—if the wound be not too large—the skin slowly extends by growth from the edges of the wound, until complete repair takes place. Such healing is known as healing by granulation or healing by second intention. In some cases the growth of new blood-vessels is in excess of the production of the connective tissue, and the tufts of new and easily bleeding vessels project above the surface of the wound. These are known as exuberant granulations, or 'proud flesh.' Young granulation tissue is composed almost entirely of small round or oval connective-tissue cells and blood-vessels, the intercellular substance being very small in amount. As the tissue becomes older the connective-tissue fibres appear, the cells become fewer and more like adult connective-tissue cells. Finally the cells may almost entirely disappear, leaving dense white fibrous tissue, to which the term 'cicatrix,' 'cicatricial tissue,' or 'scar tissue' is applied.

Under certain conditions, whether due to increased nutrition of the parts or to some little-understood factor we do not know, there occurs an active increase in the connective-tissue elements of some of the organs of the body. This is known as productive inflammation. This production or new connective or interstitial tissue may be slight in amount. It may, on the contrary, be quite extensive. Its proliferation is always at the expense of the parenchyma or functionating elements of the organ, and often results in considerable destruction of the latter. Not easily differentiated from this productive inflammation is the process known as replacement connective-tissue hyperplasia, in which the formation of new tissue is secondary to degeneration of the parenchyma and for the purpose of its replacement.

The significance of the inflammatory process and the relation which it bears to the normal physiological activities of the body are matters of extreme importance. If we exclude bacterial infection with the formation of pus and the production of large amounts of fibrin, which occurs in some cases—in other words, if we take such an example of inflammation as we studied in the exposed frog's mesentery—we note that all the phenomena observed are but exaggerations of normal physiological processes. Thus in normal physiological activity the relations existing between the blood inside the capillaries and the tissues outside are extremely intimate, and serum and white blood-cells, with probably some red blood-cells, have more or less free access to the tissues. The action of phagocytes also occurs as a normal physiological process. We have referred to the pathological identity of wound repair and the inflammatory process. Such facts favor the consideration of inflammation, not as a destructive, but as a conservative process, a reaction which healthy tissue presents against external irritation. Even in the case of bacterial infection with the formation of pus, the inflammatory reaction is essentially conservative, the white blood-cells acting as distinctly germicidal agents, destroying bacteria themselves by their phagocytic powers, and when dead disintegrating and diffusing their germicidal substances throughout the serum or pus. We must thus look upon the inflammatory reaction of tissues in the presence of bacterial invasion as of the nature of a rising of the body forces for purposes of defense against the invasion.

While very convenient, inflammation is an objectionable and indefinable term. It has been suggested by Dr. A. H. Smith, of New York, to follow the nomenclature of which 'tuberculosis' is a universally accepted precedent, and give to the process resulting from the action of a morbific agent in wounds and injuries the term 'traumosis;' to the process resulting from the local action of poisons in the blood the term 'toxosis;' and to the action and results of micro-organisms the term 'bacteriosis.' The adoption of these suggestions would relieve us of our present unfortunate position of recognizing inflammation, instead of its cause, as an active process, and of allowing the inference that inflammation possesses a separate pathological energy.

Treatment. All sources of irritation and all causes of the condition must be sought and removed; local action must be lessened, complications must be avoided, or treated if present; pain must be relieved; and the patient's strength must be supported. Rest must be obtained. The patient in an exhausting case must be put to bed; inflamed parts must be supported with bandages, splints, slings, or cushions, securing proper position and slant. In many cases the application of cold is desirable, and this is secured by using an ice-bag or ice-coil, evaporating lotions, or irrigation with cold water. Heat may be desirable, to favor suppuration and encourage 'pointing' of an abscess or a furuncle. But in the case of bacterial infection heat often does harm by lowering the resistance of tissue and inviting further spread of the micro-organisms. Poultices, especially, offer rich ground for the propagation of bacteria. Local blood-letting may be desirable, by means of the artificial leech, cupping, incisions or scarifications, or punctures. Pressure, by means of gauze or rubber bandages, is occasionally indicated. Incisions may be necessary to relieve tension, as in erysipelas, where deep cuts in the axis of the limb relieve pain. Astringent and stimulating drugs may be used, such as belladonna, silver nitrate, tannic acid, hydrastis, zinc salts, etc. Counter-irritation is effectual in certain cases, in which the cautery, caustics, vesicants, or rubefacients are used.

Among the constitutional agents used in combating inflammation are blood-letting in certain cerebral or thoracic conditions; diet; drugs, including aconite, colchicum, belladonna, diuretics, iodide of potassium, opium, quinine, mercury, and purgatives. Stimulants, together with increased nourishment, may be demanded in exhaustion or in chronic cases. The measures appropriate to each disease in which inflammatory conditions arise are mentioned under the appropriate title. Consult: A. H. Smith, "Intermediate Inflammatory Process," in *Transactions of the Association of American Physicians* (New York, 1900); Delafield and Prudden, *Handbook of Pathological Anatomy and Histology* (6th ed., New York, 1901).

INFLAMMATION OF THE BOWELS. An old and inexact term, which was probably used indiscriminately as a name for enteritis, gastroenteritis, colitis, appendicitis, and peritonitis, before some of these ailments were differentiated.

INFLAMMATION OF THE BRAIN. An old and unscientific term, which has been applied to both cerebritis and meningitis, and which should be abandoned. Cerebritis, or inflammatory change of the brain-substance, may occur in vascular portions of the brain after injury. See MENINGITIS.

INFLAMMATION OF THE KIDNEYS. An unscientific term applied indiscriminately to those diseases of the kidneys one of the symptoms of which is inflammation.

INFLAMMATION OF THE LUNGS. See PNEUMONIA.

INFLECTION (Lat. *inflexio*, a bending, from *inflectere*, to bend, from *in*, in + *flectere*, to bend). The changes undergone by words to denote their varying relations to other words. This forms one of the main divisions of philology (q.v.), and is itself subdivided into conjugation (q.v.) and declension (q.v.). It is a distinguishing mark of the Indo-Germanic (q.v.) and the Semitic languages (q.v.), as compared with other language-groups, such as the so-called agglutinative (q.v.), and the like. Broadly speaking, the line between inflection and agglutination is drawn by the individual intelligibility of the components of a word. While in many non-inflecting languages each of the several formative parts has an independent meaning and existence, as Turkish *sevmek*, 'to love,' *sevdirmek*, 'to cause to love,' *sevdirilmek*, 'to cause to be loved,' *sevdirilmemek*, 'to cause not to be loved,' and so on, the components of an inflecting word no longer have any independent meaning, so that Latin *agit* means 'he drives,' but neither *agi-* nor *-t* has any signification when used separately. This distinction, however, is a somewhat artificial and evanescent one, and should be accepted only as a basis for rough classification. To all intents and purposes many of the so-called agglutinative, incorporating (or polysynthetic), or even analytic languages are as truly inflectional as those whose right to the term is undisputed. The phrase 'inflectional' may, nevertheless, be used to denote the Semitic and Indo-Germanic groups if its somewhat conventional and inexact applicability be clearly understood. The inflections of the Semitic languages are relatively simple, and will be treated in detail under the title SEMITIC LANGUAGES. In the Indo-Germanic family, on the other hand, they are quite complex, although far surpassed by many of the agglutinative and incorporating tongues. In general, the Vedic Sanskrit (see SANSKRIT LANGUAGE) seems to come nearest to the hypothetical pre-Indo-Germanic language-type. It has two main declension systems, pronominal (see PRONOUN) and nominal (see NOUN). These were probably independent originally, although by the operation of analogy (q.v.) the two systems of declension frequently became confused, some cases of the noun being inflected pronominally (e.g. Sanskrit *tē*, Greek *οἱ*, 'these,' λύκοι, but Sanskrit *vṛkās*, 'wolves'), and vice versa (as Oscan *Núvlanús*, 'citizens of Nola,' *pús*, 'who?' but Latin *qui*, Sanskrit *kē*). The inflection of the pre-Indo-Germanic noun and pronoun was evidently far richer even than the Vedic Sanskrit, for a comparison of the Indo-Germanic languages shows a number of terminations for single cases—as, for instance, the instrumental singular Avesta *vehrka*, Sanskrit *vṛkē-ṇa*, Armenian *gailov*, Old Church Slavic *vlŭkomi*, 'with a wolf.' It is entirely possible, even though merely a hypothesis, that the four modes of formation of this case just cited, which would be in pre-Indo-Germanic **u̯l̥qō*, **u̯l̥qē*, **u̯l̥qobhi*, **u̯l̥qomi* (also **u̯l̥qebhi*, **u̯l̥qemi*), indicate an original differentiation of meaning; or, in other words, they were different cases. These cases, if this is true, later syncretized, a process for which the historic Indo-Germanic dialects furnish abundant analogies, as the Latin ablative, which unites the functions of the pre-Indo-Germanic locative, instrumental, and ablative, or the Greek dative, which comprises the primitive dative, locative, and instrumental. The inflectional terminations are, in general, ultimately the same for any given case throughout the various declensions. The apparent divergencies are usually due, except where nouns are inflected pronominally or pronouns nominally, to the phonetic laws of sound-combination. (See PHONETICS.) The conjugation of the verb, likewise, was originally far more complex than it is now. The tense system, although the future was originally lacking, was rich, especially in aorists. The Vedic Sanskrit had three main varieties, the simple, reduplicating, and *s-* aorists, of which the first had two subdivisions, and the third had four. Here again it is quite possible that these seven aorists originally had distinctive meanings, although even as early as the Veda they were, so far as now known, mutually equivalent. The moods were more numerous, the verb having the indicative, subjunctive, optative, imperative, and perhaps a mild imperative called the injunctive (in form the augmentless aorist, and later the augmentless imperfect). As inflection was twofold, so conjugation had a double system, primary and secondary. The primary conjugational terminations were found in the present, perfect, and when a future was developed, in this new tense also; the secondary endings were employed in the tenses which denote past time.

The older writers on comparative linguistics devoted much attention to the original meanings of inflectional terminations. A deeper research has, however, led to less dogmatic views, and it would seem that, in our present state of knowledge, no conclusion as to their primitive force of inflections can be reached. It may be true that *s* is characteristic of the plural (as Gothic *wulfōs*, *wulfans*, Sanskrit *vṛkēṣu*, *vṛkēbhyas*, *vṛkāiṣ*, 'wolves'—nom., acc., loc., abl., instr.), but *s* is also a mark of the nominative masculine and genitive singular (as Latin *lupus*, 'wolf,' Greek *ὄφιος*, 'of a serpent'). It is just possible that the case-endings were indeed originally independent words, which became stereotyped and meaningless terminations. A possible analogue is furnished by the modern Indo-Iranian languages as compared with the ancient, as Hindu *ghōṛake*, 'of a horse,' corresponding to Prakrit *ghōḍaassa kacchē*, Sanskrit *ghōṭakasya kakṣē*, 'at the side of a horse,' or Persian *šāhrā*, 'for the king,' corresponding to Old Persian *xšāyaθiyahyā rādiy*, 'for the sake of the king.' This, however, is a mere hypothesis, a suggestion of a process which may have taken place. In the case of the verbs, repeated endeavors have been made to trace the endings back to the personal pronouns. Thus the terminations of Sanskrit *bharāmi*, *bharati*, *bharāvas*, 'I bear,' 'he bears,' 'we two bear,' may be compared with some plausibility with *mām*, 'me,' *tam*, 'him,' *āvām*, 'we two,' but the other persons of the verb oppose such a hypothesis. It is true that many agglutinative languages seem to bear out the old view; but it is, notwithstanding this, too faulty a theory to be adopted as even plausible, much less probable.

Inflection comes only at the end of an Indo-Germanic word, excepting in the reduplication of the aorist and perfect (as Sanskrit *ajījanam*, aorist of *jan*, 'to be born,' *tutōda*, perfect of *tud*, 'to thrust,' Greek *γέγονα*, perfect of *γίγνεσθαι*, 'to become,' Latin *memordi*, perfect [aorist] of *mordere*, 'to bite,' Gothic *haíhait*, preterite of *haitan*, 'to call'). This reduplication is probably intensive in origin, as is seen in the intensive or frequentative and desiderative conjugations in Sanskrit. The separable initial letter used regularly in Sanskrit and Greek, and sometimes in Armenian, to denote past time when prefixed to a preterite tense (as Sanskrit *abharam*, imperfect of *bhar*, 'to bear,' Greek *ἔφερον*, imperfect of *φέρειν*, 'to bear,' Armenian *ekaç* beside *kaç*, preterite of *kal*, 'to stand') does not properly belong to inflection, and the same exclusion holds true with regard to ablaut (q.v.).

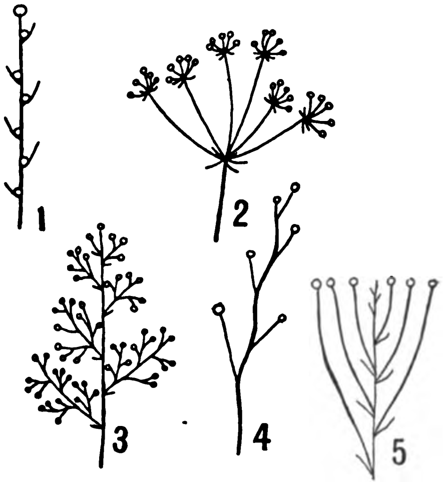
Inflection may, however, be internal and initial as well as final in Semitic. As examples from Arabic, which is the most highly inflected of all the Semitic dialects, may be cited *qatala*, 'he kills,' *qutila*, 'he is killed,' *yaqtulu*, 'he killed,' *yuqtalu*, 'he was killed,' *uqtul*, 'kill!' *tuqātilūna*, 'ye fought,' or *wajaba*, 'it is necessary,' *ujibu*, 'I made it necessary,' *nastawjibu*, 'we considered it necessary for ourselves.'

The decay and loss of inflection has been constant from the pre-Indo-Germanic period to the present day. The analytic type of language (see PHILOLOGY) has steadily encroached on the inflectional, until we have such relatively inflectionless languages as the English and the modern Persian. It is still a moot question whether the growth of the analytic type at the expense of the inflectional marks an advance. Certain scholars, notably Jespersen in his *Progress in Language with Special Reference to English* (London, 1894), have answered in the affirmative, for in an inflectional form, as Latin *amaveram*, 'I had loved,' we have the attitude of the speaker, the person of the speaker, the time of the action, and the verbal force all combined, which may be more elements than are necessary in some instances for the speaker's immediate purpose. On the other hand, the inflectional languages are more compact than the analytic. A fair answer to this problem may be that the surrender of inflection to analysis marks a linguistic loss but a psychological gain. Such a conclusion carries with it the implication that, as psychological requirements ultimately condition all but the mechanical (phonetic) side of language, the final balance is in favor of the analytic type of speech.

Consult Brugmann, *Grundriss der vergleichenden Grammatik der indogermanischen Sprachen*, vol. ii., part 2 (Strassburg, 1892).

INFLECTION IN LIGHT. See DIFFRACTION AND DIFFRACTION GRATINGS.

INFLORESCENCE (from Lat. *inflorescere*, to begin to flower, from *in*, in + *florescere*, to begin to flower, from *florere*, to flower, from *flos*, flower; connected with OIr. *bláth*, OHG. *bluoma*, Ger. *Blume*, Goth. *blōma*, Icel. *blōme*, flower, and with AS. *blōstm*, Eng. *blossom*). The manner in which flowers are arranged in a cluster; or sometimes simply a flower-cluster. In many plants the flowers occur singly, either at the end of the stem or among the leaves; but when a definite region of the plant is set apart for flowers, it is called an inflorescence. The arrangement of flowers in such clusters is very diverse, and numerous technical terms are employed to designate the different kinds of inflorescence. All kinds, however, are usually reduced to two categories, the indeterminate or *botryose*, and the determinate or *cymose*.



INFLORESCENCE.

1, Spicate raceme; 2, compound umbel; 3, panicle; 4, elongated cyme; 5, corymb.

In the botryose type no flower stands upon the end of the axis, which therefore may continue its growth indefinitely (hence an 'indeterminate' inflorescence). As a consequence, the flower-buds continue to appear at or near the growing tip of the axis, and since the older flowers are below, this method is called *acropetal* or *ascending*. There are numerous forms of the botryose type, conspicuous among which are the following: *Raceme*, in which each flower, upon its own stalk, stands upon an elongated axis, as in spring-beauty (Claytonia) and shepherd's-purse (Capsella). Such an inflorescence is elongated, open, and spray-like. *Panicle*, a modification of the raceme, in which the flower-stalks, especially the lower ones, branch, bear a small cluster of flowers, and together produce a general cluster more or less pyramidal in outline, as in the spray-like inflorescence of many grasses (as red-top). *Thyrsus*, a modification of the panicle, in which the flowers are so congested as to form a compact pyramidal cluster, as in the lilac and a bunch of grapes. *Spike*, a modification of the raceme, in which the individual flowers have no stalks, but rest directly upon the elongated axis ('sessile'), as in the common plantain and many grasses (e.g. timothy). Sometimes these sessile flowers are so close together as to cover the axis completely, in other cases they are more or less scattered along it. A *spikelet* is literally a small spike, but the term is applied almost exclusively to the small spicate flower-clusters which together make up the general spike or panicle of grasses. *Ament* or *catkin*, practically the same as a spike or raceme, but with the subtending bracts so conspicuous as to conceal the flowers until pollination, as in the pussy-willow, alder, birch, etc., which in consequence are often called 'amentaceous' plants. *Spadix*, a modification of a spike, in which the axis becomes fleshy, as Jack-in-the-pulpit (Arisæma) and calla. In this case the fleshy spike or spadix is more or less enveloped by a great ensheathing bract called the *spathe*, which is often conspicuously colored. In the calla it is waxy white, and represents to most persons the 'flower.' This inflorescence is characteristic of the great family of Aroids. *Corymb*, in which the stalks of the lower flowers are elongated in such a way as to produce a more or less flat-topped cluster. In such a cluster the lower flowers are the outermost, and as they bloom first, the order of blooming, while really ascending or acropetal as in the raceme, appears to be from the circumference toward the centre, or *centripetal*. Most of the so-called corymbs are cymes (see below). *Umbel*, in which the floral axis does not elongate. The flower-stalks appear therefore to rise from the same point, like the braces of an umbrella. This also results in a flat-topped cluster, as in wild carrot, wild parsnip, etc. Since each flower-stalk is usually subtended by a bract, in an umbel the bracts are thrown together in a rosette, which is called the *involucre*. Umbels very often become compound, that is, each main stalk ('ray') of the cluster bears another umbel, so that the general umbel is composed of a collection of small ones called *umbellets*, whose involucres are called *involucels*. This inflorescence is characteristic of the great family Umbelliferæ. *Head*, a modification of an umbel, in which the flowers are sessile (without stalks), and result in a compact, head-like cluster, as in sunflower, dandelion, etc. In this case also an involucre is a conspicuous feature, and in the great family Compositæ the whole head with its numerous flowers is commonly thought to be a single flower.

In the *cymose* type of inflorescence the first flower appears at the end of the axis, which therefore ceases to elongate (hence a 'determinate' inflorescence). As a consequence, the flower-buds appear successively down the axis, hence this method is called *basipetal* or *descending*. There are several modifications of the cymose type, but the single term in most common use is *cyme*, which names a flat-topped cluster resembling a corymb. It may be distinguished easily, however, by the fact that the flowers begin to bloom in the centre (top) of the cluster, and the succession is toward the circumference, or *centrifugal*, as in elder and hydrangea. A *glomerule* is a cyme in which the flowers are so much crowded as to form a sort of head, as in some dogwoods.

IN'FLUEN'ZA (It., influence), Epidemic Influenza, or La Grippe. An infectious disease due to a specific bacillus and characterized by great weakness and prostration, with mental depression, and generally by catarrh of the nasal and respiratory passages.

History. Authentic epidemics of influenza have occurred frequently since 1173. In that year the disease spread over Italy, Germany, and England. The next epidemics occurred in 1239 and 1311, as far as available records show, though it is possible that the pestilence which devastated France in 1311 was of another nature. In 1323, 1327, 1387, and 1403 epidemics of *la grippe* certainly occurred, as well as in 1404, 1411, 1414, and 1427. The first pandemic of the disease reported appeared in 1510 and spread over all Europe, apparently arising in Africa. It was benign in character. In 1557 occurred a repetition of the experience, all Europe suffering, having been invaded by way of Asia, and spreading, some historians report, to America. The mortality from this epidemic was very large. In 1580 the second pandemic appeared, and it was characterized by special virulence. Epidemics followed in 1591, 1593, 1597, and 1626. In 1647 the influenza spread through the plantations of America, and in the West Indies. Hubbard reports that there died in Barbadoes and Saint Kitts 5000 or 6000 each. 1658, 1675, 1688, 1693, 1709, 1712, 1729, and 1732 were *grippe* years. In the last-named year the American colonies suffered, as also the West Indies, Mexico, and South America, Russia, Poland, Germany, Switzerland, Holland, England, Scotland, France, Spain, and Italy were attacked in about the order named. People upon vessels in the open sea were said to have been attacked. In 1737 and 1742-43 the dread disease reappeared. In accounts of the latter epidemic the terms 'influenza' and 'grippe' first appeared. In 1758, 1761, 1762, 1767, 1775, 1780, 1781-82, 1788-89, 1799-1800, 1802-03, the disease was reported in epidemic form, and from 1803 to 1830 it spread from country to country, disappearing and reappearing after short intervals. China is supposed to have suffered most in 1830-32, Upper Asia, Europe, and North Africa being invaded in 1833. From 1836 to 1848 it prevailed in various localities, as also from 1850 to 1889. In 1847-48 the influenza was pandemic, with a high mortality. The pandemic in which the present generation is most interested began in 1889, when the disease overflowed the whole globe. Since that date the country has hardly been free from influenza, for the epidemic of 1893-94 must be viewed as a recrudescence of the former epidemic, individual cases or small epidemics having been separately observed. The pandemic of 1889 originated in Central Asia. From Bokhara it was traced successively to Siberia, European Russia, Sweden, Denmark, France, Germany, Belgium, and England; Asia Minor, Italy, Turkey, and Greece being attacked simultaneously with Germany and England. Shortly thereafter it appeared in Tunis, later in Mexico, South America, and Australia. It invaded Boston at the same time London was attacked, and San Francisco contemporaneously with Buenos Ayres. It appears to invade trading centres and railroad towns much earlier than sparsely settled districts in the same locality. Human intercourse and especially commerce appear to be the determining factors in its dissemination.

Cause. The aërobe causing influenza is called *Pfeiffer's bacillus.* It was discovered in 1891 by Pfeiffer, Kitasato, and Canon, working independently. It is a bacillus occurring singly, in pairs, or chains, or clumps, appearing as a straight rod with rounded ends, non-motile, and not forming spores. It is best stained by a weak solution of carbol-fuchsin applied for at least ten minutes. The bacillus grows best on glycerin-agar smeared with blood, at body temperature. The bacilli are found chiefly in the respiratory passages, mixed with other organisms, in the nasal mucus, or in the sputum from the bronchi, and even penetrating to the submucous stratum of the mucous membrane. They are occasionally found in the blood in small numbers. They are found in the secretion in grippal middle-ear inflammation, and also in the exudate in cases of grippal meningitis. The chief symptoms of the disease are due to toxins resident in the bodies of the bacilli or produced by them as excretory matter, and absorbed by the victim from the respiratory tract. The bacillus has not been found in any other disease, but is always present in the secretions of the respiratory tract in true influenza. Experimental inoculation of monkeys has caused high fever, followed by death, no definite results being reached. But there is no evidence that any of the lower animals suffer from influenza under natural conditions.

Symptoms. The symptoms of a typical attack of influenza are headache with especially severe pain in the orbits and at the base of the occiput; fever, with a temperature of 102° or 103°, generally following an initial chill; great prostration and weakness with mental depression; pain in many of the joints and bones, and tenderness in the muscles; swelling of the mucous lining of the nasal passages with increased flow of mucus; cough, with expectoration of small masses of thick, yellowish or greenish mucus, accompanied by tenderness in the region of the breast-bone; rapid and generally weak pulse; buzzing noises in the ears; and slight tremor of the whole body. There is an inflammation of the throat, its mucous lining being congested and the palatal folds swollen and rigid. There may be sudden attacks of vertigo or of syncope, or of unconsciousness resembling that due to apoplexy. In some cases, in the place of severe catarrhal symptoms, an eruption, resembling an urticaria, appears on the body. In others, the most severe symptoms are referable to the gastro-intestinal tract; the tongue being coated, the breath foul, the abdomen very tender on pressure, vomiting occurring, and the action of the bowels being irregular. In still other cases the headache, backache, neuralgia (trigeminal, occipital, cervicobrachial or intercostal), myalgia, insomnia, syncope, and vertigo are the most prominent symptoms. The predominance of sets of symptoms in certain classes of cases has led to the attempt by some physicians to divide influenza into respiratory, gastro-intestinal, and nervous forms, of which the last has been fairly adopted. In all cases there is danger of pneumonia (q.v.). Both pleuræ and lungs are involved with surprising rapidity very early in some cases, with or without bronchial implication. The pneumonia is lobular in variety, disseminated in separate areas throughout the lungs, with irregular and atypical invasion. It resolves by lysis and not by crisis, and predictions of its termination are impossible. The grippe-pneumonia is much more fatal than the ordinary lobar pneumonia. The only safe place for a patient with influenza is in bed, during the attack, lest myocarditis (q.v.) or pneumonia should suddenly appear, and the patient's life be actually jeopardized, and lest the effort to continue one's vocation in spite of undermined strength result in a protracted neurasthenia as a sequel to the attack.

Treatment. The treatment of epidemic influenza consists in rest in bed, as has been said, as soon as the prostration supervenes, or the temperature rises above the normal. Among drugs, quinine occupies the front rank. It is of great value in every case, not in large doses and not necessarily prolonged. Other drugs of value, at different stages or in different types of the disorder, are antipyrin, phenacetin, salipyrin, salicylate of sodium, iodine, digitalis, benzol, carbolic acid, ipecacuanha, camphor, alcohol, and strychnine. Several of these remedies being powerful and dangerous drugs, they should not be indiscriminately used, or used at all without a physician's advice. A weak heart may be crippled by the unintelligent use of a depressant or an over-stimulating drug.

Prophylaxis. The contagium of the disease is carried by the sputa and the nasal mucus, and precautionary measures should be employed, where possible, to limit the disease. *Grippe* patients in hotels, sanitariums, and schools should be isolated. Their table utensils and bed-linen and body-clothes should be disinfected with boiling water. Prevention should be secured of the deposition of secretions upon carpets or furniture. Gargle, nasal sprays, and mouth-washes prevent infection by clearing out mucus that might form a nidus for the disease in a healthy mouth. Quinine internally is a good prophylactic. The bacillus has been found dead after two hours' exposure to sunlight or dry air, in nasal mucus. Infection of another may occur from the moisture in the breath of a patient, who coughs out a spray of fine mucus into the atmosphere. Reinfection of a convalescing patient frequently occurs. Patients should therefore cough into a moist handkerchief; avoid kissing others; use separate utensils at table; sterilize these and all clothing of body and bed; spit into a cup containing water, this cup to be cleansed frequently with very hot water; or if in a school, hotel, sanitarium, etc., be isolated. Patients suffering with tuberculosis, bronchitis, pharyngitis, or nasal catarrh should avoid mingling with *grippe* patients.

BIBLIOGRAPHY. Huxham, *Opera Physio-Medica* (Leipzig, 1784); Schweich, *Die Influenza* (Berlin, 1836); Wolff, *Die Influenza-Epidemie, 1889-92* (Stuttgart, 1892); Edson, *La grippe* (2d ed., New York, 1894); Finkler, "Influenza," in *Twentieth Century Practice* (New York, 1898). See BACTERIA; EPIDEMIC.

INFLUENZA (in animals), EPIZOÖTY, PINK-EYE, TYPHOID FEVER, or BILIOUS FEVER (Fr. *grippe*, Ger. *Pferdestaupe*). A contagious fever affecting the horse, ass, mule, and occasionally dogs and cats. The animal is dull and indifferent to surroundings, has a rapidly developing fever, and stands with its head down. The eyes become puffed, and secrete a watery discharge, and the mucous membranes of the eye and mouth become reddened or yellowish. Dropsical swellings may appear on the legs and under surface of the abdomen. When the disease has run its course, which requires a period of about four days, the fever abates as rapidly as it began. Death may occur from extreme fever, failure of the heart's action, or from the disintegration of the red blood-corpuscles. The most important complications of the disease are inflammatory processes in the lungs in about 50 per cent. of the cases, in the brain, or laminar tissue of the feet. The majority of horses are susceptible to influenza, and it is fatal in many cases, even with the best treatment. Since the red corpuscles are destroyed by the disease, bleeding should not be practiced except in strong subjects. Quinine and salicylic acid in dram doses usually lower the temperature. Baths of alcohol, turpentine, or hot water are useful in relieving congestion of the lungs. Aconite has an almost specific action in congestion of the brain. Digitalis may be used with advantage in cases of excessive weakness of the heart.

IN FORMA PAUPERIS. See FORMA PAUPERIS, IN.

INFORMATION (Lat. *informatio*, outline, representation, from *informare*, to sketch, to inform, from *in*, in + *forma*, shape). In English and American law, a summary method of instituting criminal proceedings at the instance of the Government, and without the process of indictment (q.v.). The free use of this proceeding by the Tudor and Stuart kings and its abuse by the Court of Star Chamber constituted one of the grave abuses of the royal prerogative at which the revolutions of 1645 and 1688 were aimed. The process was greatly restricted by act of Parliament in 1641 (16 Car. I., c. 10) and 1693 (4 & 5 Wm. and Mary, c. 18). In theory, the right to institute criminal proceedings by information was always limited to the classes of offenses known as misdemeanors, but the distinction between misdemeanors and felonies was too indefinite to make this a complete safeguard of the liberty of the subject. The Constitution of the United States (Amendments Art. V.) restricts the use of informations to crimes which are not capital or of an infamous character by requiring an indictment by a grand jury in all such cases. In practice, at the present time, in England an information filed by the Attorney-General or Master of the Crown Office is resorted to only in cases of such misdemeanors as tend to disturb the peace or the Government—for example, as libels on judges, magistrates, or public officers, bribery at elections, etc. This information is usually called a criminal or an ex-officio information, and the defendant is put on his trial in the same way as under an indictment. In form and substance it is precisely like an indictment, differing from it only in the fact that it is presented upon the official oath of a duly authorized officer of the Government, and not upon presentment by a grand jury. There are other informations, such as those called *quo warranto*, to test the validity of an election or appointment to a public office, etc. An information by the Attorney-General in chancery is a suit on behalf of the Crown or Government as to any misapplication of a public charity, or on behalf of an idiot's or lunatic's property. The term is also commonly used to denote the written statement made on oath before a justice of the peace, previous to the issuing of a summons or complaint against a person charged either with a crime or an offense punishable summarily. There are also informations in the Court of Exchequer to recover penalties for the breach of the revenue laws. The term is not now used technically in Scotland, except in cases of difficulty, when the court of justiciary orders informations—i.e. written arguments.

In the United States courts actions for minor offenses, such as attempts to evade the revenue laws, etc., sometimes proceed upon information. In several of the States, all misdemeanors, except misprision of treason (q.v.), may be prosecuted upon information, but in the case of felonies indictment is everywhere necessary. In Pennsylvania and some other States it is optional to proceed by either method. Information is often the form of proceeding in civil cases. By this process a person filling a civil office may be brought into court to show by what authority he assumes to exercise the functions thereof, with a view to his displacement in case it can be shown that his authority is insufficient, and that the office belongs to another. If an unincorporated association assumes corporate powers, it may be ousted by this process, while a legal corporation may be thus arraigned for a violation of its charter or any infraction of law. See the bibliography under CRIMINAL LAW, and consult: Blackstone's *Commentaries on the Laws of England;* and Stephen, *History of the Criminal Law of England* (London, 1883).

INFORMER. In English and American law, a person who brings a criminal accusation against another. This term is not technically applicable to the officer of the Government who presents an information (q.v.) against an offender, but to the person on whose 'relation' the proceeding is instituted. At common law the informer had no private interest in the proceeding instigated by him, but by statute in many classes of cases, especially in violations of the revenue laws, informers are given a right of action for a penalty imposed by the law. The term informer has thus come to be commonly employed to describe a person entitled to enforce such a claim or demand. In England, when the informer sues in such an action, it is called a penal or *qui tam* action; but, in general, the penalty is now recoverable before justices of the peace in a summary way. In informations and suits in chancery, which require to proceed in the name of the Attorney-General, the informer is called a *relator*. In Scotland an informer is the party who sets the lord advocate in motion in criminal prosecutions; and the lord advocate is bound to give up the name of the informer, who is liable in case of malicious prosecutions. See the authorities referred to under Criminal Law.

IN′FRALAPSA′RIAN (Lat. *infra*, below + *lapsus*, p.p. of *labi*, to slip), or Sublapsarian. In theology, one who holds that God permitted the fall of man without positively foreordaining it, and makes His election of certain men to salvation and others to condemnation dependent upon His foreknowledge of the fall. According to this view, God determined to create the world, to permit the fall, and to elect from the mass of fallen men some to eternal life, and leave the residue to suffer the just penalty of their sins. Election is thus made from those fallen by their own act, and this act is not necessitated by the divine power. Opposed to this view is that of the supralapsarians, who hold that the fall of Adam with all its evil consequences was predetermined from eternity, and that election to salvation or reprobation precedes the purpose to create and permit the fall, and has no relation to it. God's purpose in creating and governing the universe is to manifest His attributes and glory; and He decrees the fall and creates some to be saved and others to be lost to exhibit His grace and justice. John Calvin is frequently regarded as the chief exponent of supralapsarianism; yet passages may be quoted from his works favoring the other view. The terms themselves did not come into use until after his time. The majority of the Synod of Dort (q.v.) and the Westminster Assembly were infralapsarians. The distinction is not confined to Calvinists. It is found also among the Roman Catholics. See Election; Fall, Doctrine of the; Foreknowledge and Foreordination.

INFRINGEMENT (from Lat. *infringere*, to break, from *in*, in + *frangere*, to break; connected with Goth. *brikan*, OHG. *brehhan*, Ger. *brechen*, AS. *break*). In its most general sense, any violation of a law or invasion of a legal right which gives rise to a cause of action, in law or equity, in favor of the person injured thereby. The term is, however, more commonly employed in a technical sense to describe an unlawful appropriation of ideas, principles, or rights when protected by copyrights, patents, or trademarks. The usual and proper remedy for an invasion of these statutory rights is an action at law for the damages sustained; or a court of equity will, upon application, enjoin the infringement, thus securing an absolute enjoyment or monopoly of the principles or ideas embraced in the work or device so protected.

Infringement of a Patent Right. The manufacture, use, or sale of a thing, the subject matter of which is the principle or novelty of a patented invention, constitutes an infringement of the latter. To prove that an alleged new device incorporates the substance of an invention so protected, it is necessary to establish that the same result is accomplished, the same functions performed, and that the mode of operation is substantially the same. If these characteristics are present a mere change in the form or in the location of the parts of a patented article will not save the device thus constructed from being an infringement of the patentee's rights. See Patent; and consult the authorities there referred to.

Infringement of Trademark. This consists in the unlawful use of a mark or device which another has registered to provide a means of identification of his goods for the general public. Any device which is so similar to a registered trademark as to deceive or mislead the public constitutes an infringement thereof, even though it would not be difficult to distinguish the two when placed together. The usual remedy for such infringement is by injunction. See Trademark; Trade Name; Label; etc. Consult the authorities referred to under Trademark. For the treatment of the subject of *Infringement of Copyrights*, see Copyright; Literary Property; and also Abridgment.

IN′FUNDIB′ULUM (Lat., funnel). A term used in anatomy to denote tubular passages that are somewhat funnel-shaped. The infundibulum of the brain is a hollow process continuous with the tuber cinereum, and terminating in the pituitary body. The infundibulum of the nose, or infundibulum of the ethmoid bone, is a long cellular canal which passes from the frontal sinus through the anterior ethmoidal cells to the middle meatus of the nose. The infundibulum of the heart, or conus arteriosus, is that portion of the right ventricle of the heart which approaches the orifice of the pulmonary artery. The infundibula of the kidney are the three prolongations of the pelvis of the kidney, which are in turn subdivided into the calices.

INFUSION (Lat. *infusio*, a pouring in, from *infundere*, to pour in, from *in*, in + *fundere*, to pour; connected with Goth. *giutan*, AS. *gēotan*, OHG. *giozan*, Ger. *giessen*, Gk. *χεῖν*, *chein*, Skt. *hu*, to pour), or Infusum. A term applied in pharmacy to an aqueous solution of a vegetable substance obtained without the aid of boiling. Such solutions are usually prepared by digesting in soft water (which may be either hot or cold, according to circumstances) the sliced or powdered substance in an earthenware vessel fitted with a cover. Cold water is preferable when the active principle is very volatile, or when it is expedient to avoid the solution of some ingredient in the vegetable which is soluble in hot, but not in cold water. In most cases, however, boiling water is employed. Infusions are preferred to decoctions when the active principle volatilizes at a boiling heat, as in the case of essential oils; or when ebullition readily induces some chemical change.

Infusions may also be prepared by percolation (q.v.), a process which is extensively employed in the preparation of tinctures. In all cases they should be prepared freshly for each day's consumption. Some pharmacists add less water than the stated amount in preparing an infusion by percolation, then add a considerable percentage of alcohol, and stock the preparation till demanded. When ordered, they add to this 'concentrated infusion' enough water to equal the proportion in the fresh article.

IN′FUSO′RIA (Neo-Lat. nom. pl., from Lat. *infusorium*, reservoir of a lamp, from *infusor*, pourer, from *infundere*, to pour in). The highest or most specialized class of Protozoa (q.v.). The name is of interest historically because originally applied to all those microörganisms which swarm in organic infusions, but it became gradually restricted to its present limits with the advancement of biological research. The name was first used by Müller in the latter part of the eighteenth century; and the class Infusoria was removed from the 'Polypes' by Lamarck in 1807. The name of Ehrenberg is, however, especially associated with the Infusoria, his epoch-marking work on them appearing in 1837. The most recent monograph of the group is that of Kent, *A Manual of the Infusoria* (London, 1880-82).

INFUSORIAL EARTH. See DIATOMACEOUS EARTH.

INGALLS, ĭn'galz, JOHN JAMES (1833-1900). An American politician, born at Middleton, Mass. He graduated at Williams College in 1855, studied law, and in 1857 was admitted to the Massachusetts bar. In the following year, becoming interested in the 'free State' movement in Kansas, he removed to Atchison in that State, and began practice. He was a member of the Wyandotte Convention in 1859, was elected Secretary of the Territorial Council in 1860, and after the admission of Kansas to the Union in January, 1861, became secretary of the new State Senate. The next year he was a member of the Senate, and was an unsuccessful candidate for the Republican nomination for Lieutenant-Governor. From 1863 to 1865 he was editor of the *Atchison Champion*, and in 1873, after a sharp contest, was elected by the Republican Legislature to the United States Senate. In the Senate, to which he was reëlected in 1879 and 1885, he was a fluent and frequent speaker, brilliant at repartee, and was an excellent parliamentarian. He was a faithful champion of the various Republican administrations, and was president *pro tempore* of the Senate from 1887 until 1891, when he lost his seat as a result of the Democratic-Populist successes in his adopted State. He spent his last years in lecturing and in various journalistic enterprises.

INGALLS, RUFUS (1820-93). An American soldier, born in Denmark, Maine. He graduated at West Point in 1843, and served through the war with Mexico. In 1854-55 he accompanied Colonel Steptoe's expedition across the continent. During the Civil War he served with the Army of the Potomac, chiefly in the quartermaster-general's department, and was present at many of the most important battles, including Fredericksburg, Chancellorsville, Gettysburg, and the Wilderness. He was mustered out of the volunteer service on September 1, 1866, with the brevet rank of major-general both in the volunteer and in the regular army. In 1882 he was made brigadier-general and quartermaster-general, and on July 1, 1883, was retired upon his own application.

INGAUNI, ĭn-ga̤'nē. An ancient tribe dwelling on the mountains and seacoast of what is now the western Riviera of Italy. They were active in the wars between the Romans and Ligurians, and were allies of the Carthaginians in the Second Punic War. After the battle with Æmilius Paulus, B.C. 181, in which they lost 15,000 men, very little was heard of them. Their chief town was Album Ingaunum, or Albingaunum (now Albenga).

INGEBORG, ĭng'*e*-bôr-y', or **INGEBURGE**, ing'*e*-bo͞or'*ge* (1176-1236). A French queen, born in Denmark. She was the sister of Canute IV. of Denmark, and married Philip Augustus, King of France, in 1193. About three months after this marriage the King repudiated her and obtained a divorce. Pope Innocent III. supported the Queen's rights and excommunicated Philip, who had meanwhile married Agnes of Meran (1198). Philip promised to reinstate the Queen, but she was first imprisoned, and it was not until 1213, just before he left for England on his expedition against King John, that she regained her rights.

INGELOW, ĭn'jē-lō, JEAN (1820-97). An English poetess and novelist, born in Boston, Lincolnshire. To the public she was unwilling to give the details of her life. Her first volume of verse, *A Rhyming Chronicle of Incidents and Feelings* (1850), published anonymously, excited considerable interest. Another volume, *Poems* (1863), which included "The High Tide on the Coast of Lincolnshire," attained instant success by reason of its freshness of thought and novelty of expression. Subsequently she wrote *A Story of Doom* (1867), and *Poems of the Old Days and the New* (1885). Her prose works include the novels *Off the Skelligs* (1872); *Fated to Be Free* (1875); *Sarah de Berenger* (1879); *Don John* (1881); *John Jerome* (1886); besides *Stories Told to a Child; Mopsa the Fairy; Studies for Stories; The Suspicious Jackdaw; A Sister's Bye Hours; Quite Another Story; A Motto Changed* (1893); and others. Jean Ingelow is at her best in descriptive lyrics. By the side of "The High Tide" should be placed "Divided." The charm of her poetry also passed into some of her novels, notably *Off the Skelligs*, and *Mopsa* is a pretty tale of fairyland. Consult her *Poems* (Boston, 1892).

INGEMANN, ĭng'*e*-män, BERNHARD SEVERIN (1789-1862). A Danish poet and novelist. He was born at Torkildstrup, on the island of Falster, May 28, 1789, and was trained at the University of Copenhagen. His first *Poems* (1811) were of a dreamy and melancholy religiosity. *Procne* (1813) shows evidences of requited love; *The Black Knights* (1814) marks growing power, and the tragedy *Blanca* (1815) achieved a success of sentimental sensation. Ingemann received a Government stipend, traveled, and on his return showed marked talent in narrative in *Stories and Fairy Tales* (1820). *Magnetism in a Barber's Shop*, an unsuccessful comedy, closed his career as a playwright (1821). He now became an academic lecturer at Sorö, married and wrote historic poems and novels voluminously, with a childlike faith that he was contributing to history (*Waldemar the Victorious*, 1826; *Erik Menved's Childhood*, 1828; *King Erik and the Outlaws*, 1833; *Prince Otho of Denmark*, 1835, and others). He wrote also a collection of very popular *Evening and Morning Hymns*. In the last decade of his life his work was almost wholly religious. His last book, *The Apple of Gold*, appeared in 1856. Ingemann's collected *Works* were published in forty-one volumes (Copenhagen, 1843-65). Consult: Ingemann's *Autobiography*, edited by Galskjt; *Min Levnetsbog* (Copenhagen, 1862); Heise, *Breve til og fra Ingemann* (ib., 1879); Norregård, *Ingemanns Digterstilling og Digterværd* (ib., 1886).

INGENHOUSZ, Iŋ'gen-hous, Jan (1730-99). A Dutch scientist. He was born in Breda, and studied and practiced medicine in his native country, but removed to London about 1765. Accident brought him an introduction to the Austrian Imperial family, whom he served professionally with such success that, in 1769, he was made aulic councilor and body physician to Maria Theresa and to Joseph II. In 1779 he returned to London. He devoted much time and study to research in electricity, and invented the plate electrical machine. Ingenhousz wrote several scientific treatises and essays, such as *Experiments on Vegetables, Discovering Their Great Power of Purifying the Common Air in Sunshine, but Injuring it in the Shade or at Night* (1779); *Anfangsgründe der Electricität* (1781); and *Essay on the Food of Plants and the Renovation of Souls* (1796). A number of his papers were published in two volumes in Paris in 1785-89 under the title *Nouvelles expériences et observations sur divers objets de physique.*

INGERMANLAND, Iŋ'gēr-man-lȧnd, or **INGRIA,** Iŋ'grĭ-ȧ. The old name for a region in Northwestern Russia, constituting part of the Government of Saint Petersburg. It belonged originally to Novgorod and from 1617 to 1702 it was held by the Swedes, who lost it again to Russia in the wars of Peter the Great.

INGERSOLL, Iŋ'gēr-sol. A town in Oxford County, Ontario, Can., on the Thames River, and the Grand Trunk Railroad, 19 miles northeast of London (Map: Ontario, C 4). It exports largely grain and lumber, and has manufactures of machinery, woolen goods, agricultural implements, cheese, and woodenware. Population, in 1891, 4191; in 1901, 4572.

INGERSOLL, Charles Jared (1782-1862). An American lawyer, writer, and politician, the son of Jared Ingersoll (1749-1822), a framer of the Constitution. He was born in Philadelphia, entered the College of New Jersey, where he remained three years, then studied law and traveled in Europe. In 1801 he wrote the tragedy *Edwy and Elgiva,* which was produced at the New Theatre in Philadelphia, and in 1808 he published a strong political pamphlet in defense of the Republican policy of Thomas Jefferson. Three years later appeared his *Inchiquin the Jesuit's Letters.* He was elected to Congress in 1812, was for fourteen years United States District Attorney for Pennsylvania, and again served in Congress from 1839 to 1849. Among his other publications are: *Historical Sketch of the Second War Between the United States of America and Great Britain* (1845); which deals with the events of 1812-13; and *History of the Second War Between the United States of America and Great Britain* (1852), which deals with the events of 1814 and 1815.

INGERSOLL, Charles Roberts (1821-1903). An American politician, son of Ralph Isaacs Ingersoll. He was born in New Haven, Conn., graduated at Yale in 1840 and at the Yale Law School in 1844, and, after several terms in the Connecticut Legislature, was Governor of the State from 1873 to 1877. Ingersoll took some part in national politics. He was a Democratic elector in 1876.

INGERSOLL, Ernest (1852—). An American naturalist, born in Monroe, Mich. He studied for a time at Oberlin College, and afterwards in the Lawrence Scientific School and Museum of Comparative Zoölogy at Harvard, where he was a pupil of Louis Agassiz. He went West as naturalist in the Hayden survey (1874 and 1877), and did much work with the United States Fish Commission. He became widely known as a writer of special magazine articles and of numerous guide books, and as a popular lecturer upon scientific subjects. In 1901 he was lecturer on zoölogy at the University of Chicago. His books include: *Nests and Eggs of North American Birds,* parts i.-vii. (1880-81); *Oyster Industries of the United States* (1881); *Knocking 'Round the Rockies* (1883); *Country Cousins* (1884); *The Crest of the Continent* (1884); *The Ice Queen* (1884), and other juvenile novels; *Down East Latch Strings* (1887); *Wild Neighbors* (1897); *The Book of the Ocean* (1898); *Nature's Calendar* (1900); and *Wild Life of Orchard and Field* (1902).

INGERSOLL, Jared (1722-81). An American politician, born in Milford, Conn., and educated at Yale College. In 1765, after the passage of the Stamp Act, he accepted, under Franklin's advice, the appointment as stamp agent for Connecticut; but soon, after undergoing the insults and personal abuse that fell to the lot of all Colonial stamp agents, was forced by the people to resign. In 1766 he published a pamphlet entitled *The Stamp Act.* He became an admiralty judge in 1770.

INGERSOLL, Jared (1749-1822). An American jurist, born in New Haven, Conn., son of Jared Ingersoll (q.v.). He graduated at Yale in 1766, and later went to London, where he studied law. His sympathies were with the patriot party in America, however, and at about the time of the signing of the Declaration of Independence, he went to Paris, where he became intimate with Franklin, Izard, and other Americans then in the French capital. In the autumn of 1778 he returned to America and settled in Philadelphia, where he soon became well known as a lawyer. In 1780 he was elected to Congress, and in 1787 was chosen a member of the Constitutional Convention. Among the other offices which he held were those of Attorney-General of Pennsylvania and presiding judge of the district court of Philadelphia.

INGERSOLL, Joseph Reed (1786-1868). An American politician, born in Philadelphia. He was the son of Jared Ingersoll (q.v.), a framer of the Constitution; the grandson of Jared Ingersoll (q.v.), and brother of Charles Jared Ingersoll (q.v.). He graduated at Princeton in 1804, and after studying law began to practice in Philadelphia. He was a member of Congress from 1835 until 1837, and again from December, 1841, until 1849. In 1852 he was appointed Minister to England by President Fillmore, but returned to America the next year. His most important publication is a pamphlet entitled *Secession a Folly and a Crime,* which appeared at the outbreak of the Civil War. He also wrote a *Memoir of Samuel Breck* (1863), and translated Roccus's *De Navibus et Naulo* and *De Assecuratione* (1809).

INGERSOLL, Ralph Isaacs (1788-1872). An American lawyer and statesman. He was born in New Haven, Conn., graduated at Yale in 1808, was a prominent member of the bar, and a leading Democratic speaker in the Connecticut Legislature (1819-25), earning the name of 'Young Hotspur' from his political opponents. Ingersoll was a Representative in Congress (1825-33), then Connecticut State Attorney, and from 1846 to 1848 United States Minister to Russia.

INGERSOLL, Robert Green (1833-99). An American lawyer and infidel writer and lecturer. He was born at Dresden, N. Y., August 11, 1833, the youngest of the five children of a Congregational minister of liberal views. The family removed to Illinois in 1845, and there Robert studied law, was admitted to the bar, and entered politics as a Democrat. In 1857 he made his residence in Peoria, where he soon became recognized as an able lawyer, chiefly employed in railroad litigation. In 1860 he was nominated for Congress, but was defeated. In 1862 he went to the war as colonel of the Eleventh Illinois Cavalry, and was taken prisoner, but exchanged. He returned to citizenship a Republican in politics, and was appointed Attorney-General of Illinois in 1868. In 1876, at the Republican Presidential Convention at Cincinnati, he delivered a fervid and vigorous speech in favor of the candidacy of James G. Blaine, which won for him a national reputation, and from this time he was recognized as one of the foremost orators of the country. He soon after entered the lecture field, where the matter as well as the manner of his discourse excited public attention. He developed the views of a pronounced opponent to Christianity, and, adopting religious topics as his subjects, attacked the Bible, the personal nature of the Deity, and the existence of a hell, with all the force of which he was capable, and with the advantage of splendid rhetorical powers. In matter his orations were much dependent upon the writings of Thomas Paine. Colonel Ingersoll was counsel for large corporations. He died suddenly at Dobbs Ferry, N. Y., July 21, 1899. His published works include: *The Gods, and Other Lectures* (1876); *Some Mistakes of Moses* (1879); *Great Speeches* (1887); *Lectures Complete* (1883); and *Prose Poems and Selections* (1884). His complete works were published in New York, 1900, 12 vols. Consult the biographical sketch by Hanford (Chicago, 1899).

INGHAM, Ing'am, Benjamin (1712-72). An English evangelist. He was born at Ossett and graduated from Queen's College, Oxford, in 1734. He had, in 1733, become associated with the Wesleys, and after his ordination in 1735 accompanied them to Georgia. About 1737 he became a Moravian, broke with the Wesleyans, and founded in Yorkshire many Moravian congregations, which followed him when he separated from that sect. They were known as Inghamites until their head joined Sandeman, about 1760, when they broke up.

INGHAM, Charles Cromwell (1797-1863). An American painter. He was born in Dublin, Ireland, and studied at the Dublin Institution under William Cunning. He came to America in 1817, and settled in New York. He is interesting as having been identified with the first efforts to promote painting in this country. He was one of the original members, in 1826, of the National Academy of Design, of which he was vice-president from 1845 to 1850, and one of the founders of the Sketch Club. Among his figure pieces are: "Death of Cleopatra," "Flower Girl," "Day Dream," the "White Plume." He became celebrated as a portrait painter of women and children, and as a miniature painter. Among his prominent portraits of men are those of De Witt Clinton, Lafayette, and Gulian C. Verplanck. He died in New York City, December 10, 1863.

INGHAM, Col. Frederic. The nom-de-plume under which Edward Everett Hale wrote *The Ingham Papers* (1869).

INGHAM, Samuel Delucenna (1779-1860). An American statesman and politician, born in Pennsylvania. After serving in the Pennsylvania Legislature, he was elected to Congress in 1813. He was a member of the House of Representatives till 1818, and again from 1822 to 1829. On March 6, 1829, he was appointed Secretary of the Treasury by President Jackson, a position which he held till August 1, 1831. When the Portsmouth branch of the United States Bank was complained of as being conducted with partiality toward opponents of the Administration, it was Ingham's correspondence with Nicholas Biddle, president of the bank, that resulted in its declaration of its intention to pursue an independent course, and in the consequent struggle with Jackson.

INGHAMITES, Ing'am-īts. A sect founded by Benjamin Ingham (1712-72), who, after visiting the German Moravians in company with John Wesley, endeavored to unite the chief features of the Moravians and the Methodists in a new body, called after him, Inghamites. The organization had at one time a large number of adherents in England, but Ingham and the greater part of his followers at last went over to the Sandemanians, and the sect disappeared.

INGHIRAMI, êṉ'gê-rä'mê. An Italian noble family of Volterra. Its earliest member of importance was the humanist, Tommaso (1470-1516), often called Fedra, because of his success as Phædra in a presentation of Seneca's *Hippolytus* (or *Phædra*), but best known for his Latin orations. Seven of these were published at Rome (1777), and a few critical works on Horace and Plautus are his only remaining works. His portrait by Raphael is at the Pitti Palace in Florence.—Francesco (1772-1846), an archæologist of the same family, was born at Volterra, and was educated for a soldier. He fought against France (1799), but thereafter devoted himself to antiquities and especially to Etruscan archæology. He was librarian at Florence, and at Fiesole founded a school and press. His works, valuable for the material they contain, rather than for scholarship, include: *Monumenti etruschi* (1820-27); *Galleria Omerica* (1829-51); *Pitture di vasi fittili* (1831-37); and an incomplete *Storia della Toscana* (1841-45).—His brother, Giovanni (1779-1851), an astronomer, was born at Volterra, studied there, took holy orders when he was seventeen, and from the Brera Observatory in Milan, went to Florence to the observatory established by Ximenez in the Jesuit College there. Besides text-books of mathematics and geography, his works include: *Effemeridi dell' occultazione delle piccole stelle sotto la luna* (1809-30); *Effemeridi di Venere e Giove* (1821-24); *Tavole astronomiche universali portatili* (1811); and *Carta topografica e geometrica della Toscana* (1830).

INGLE, ĭng″l, RICHARD. An English seaman, of the seventeenth century. He was engaged in the Maryland tobacco trade at the time of the Civil War in England, and, taking the side of Parliament, drove Gov. Leonard Calvert out of the province in February, 1645. In December, 1646, Calvert returned at the head of a force of hired soldiers, and regained control of the Government. During his brief period of power, Ingle behaved in a most lawless manner, and on his return to England was called upon to answer charges preferred against him. He met this attack by presenting a petition to Parliament in which he said that his behavior had been dictated by conscience, and that he had plundered only 'Papists and malignants.' He was especially exempted from the pardon extended to the other rebels by the restored proprietary Government, and last appears in history on November 14, 1653, when he endeavored to secure a share in some prize-money. Consult: Ingle, *Capt. Richard Ingle, the Maryland Pirate and Rebel, 1642-53* (in *Maryland Historical Society Fund Publications*, No. 19, 1884).

INGLEBY, ĭŋ'g'l-bĭ, CLEMENT MANSFIELD (1823-86). A Shakespearean critic, son of a solicitor, born at Edgbaston, near Birmingham, England, Oct. 29, 1823. He graduated from Trinity College, Cambridge (B.A. 1847; M.A. 1850), and was received into partnership with his father, but he gave up law and settled near London (1859), and died September 26, 1886. Ingleby wrote for the magazines, and published several books on scientific and metaphysical topics. He is, however, best known for his studies on Shakespeare, of which the most notable are: *A Complete View of the Shakespeare Controversy* (1861), a full exposure of J. P. Collier's fabrications; *Shakespeare Hermeneutics* (1875), textual criticism; *Centurie of Prayse* (1875; enlarged, 1879), allusions to Shakespeare between 1591 and 1693; and *Shakespeare: The Man and the Book* (two parts, 1877, 1881).

INGLEFIELD, Sir EDWARD AUGUSTUS (1820-94). An English admiral and Arctic explorer, son of Rear-Admiral Samuel Hood Inglefield (1783-1848). Born at Cheltenham and educated at Portsmouth, he went to sea when he was twelve. He commanded Lady Franklin's search expedition of 1852; a year later went to the relief of Sir Edward Belcher, and on his return was the first to announce the discovery by McClure of the northwest passage. He was second in command of the Mediterranean fleet (1872-75), was knighted in 1877, and was promoted to the rank of admiral in 1879. Inglefield was the inventor of the hydraulic steering gear, a painter of marine subjects, and author of *A Summer Search for Sir John Franklin* (1853), and of a *Report on the Return of the Isabel from the Arctic Regions* (in the Geographical Society's *Journal*, 1853).

INGLIS, ĭŋ'glĭs, CHARLES (1734-1816). An Anglican bishop, born in New York. After teaching school a few years he became a clergyman, and was appointed a missionary at Dover, Del. In 1765 he became assistant minister of Trinity Church, in New York City. He was prominent as a controversialist, and replied trenchantly to Thomas Paine's *Common Sense*. During the War of Independence he was a sturdy loyalist, and refused to obey Washington's command to omit from his church service the prayer for the King and royal family. He retired temporarily to Flushing, Long Island, after the Declaration of Independence, but returned to New York City after Washington's defeat, and in 1777 became rector of Trinity Church. When the British evacuated New York City in 1783 he joined the United Empire Loyalist emigration and went to Halifax. In 1787 he was consecrated at Lambeth, England, as the first Bishop of Nova Scotia, with jurisdiction over the other British North American provinces, and was the first colonial bishop of the Church of England. Dr. Inglis was honored with academic distinctions by King's College (now Columbia University), and in 1770 became one of the governors of the college.

INGLIS, HENRY DAVID (1795-1835). An English author, better known by his pen-name, Derwent Conway, born in Edinburgh. His books include: *Tales of the Ardennes* (1825); *Narrative of a Journey Through Norway, Part of Sweden, and the Islands and States of Denmark* (1826); *A Tour Through Switzerland and the South of France and the Pyrenees* (1830-31); *Spain in 1830* (1831); *The Tyrol with a Glance at Bavaria* (1833); *The New Gil Blas, or Pedro of Penaflor* (1832)—less successful than his travels: *Ireland in 1834* (1834); and *Rambles in the Footsteps of Don Quixote* (1837), illustrated by Cruikshank. He also edited the *British Critic*, a Jersey newspaper, for two years (1832-34).

INGLIS, JOHN, Lord GLENCORSE (1810-91). A Scottish jurist, born at Edinburgh. He was educated at Glasgow University and Balliol College, Oxford, entered the Faculty of Advocates in his native city in 1835, and became dean of the same in 1852. He was a conservative supporter of Lord Derby, who made him Solicitor-General and then Lord Advocate of Scotland in 1852, Lord Justice, clerk, and a president of the Court of Session in 1858, and a member of the Privy Council in 1859. In 1867, as Lord Glencorse, he became Lord Justice General of Scotland and Lord President of the Court of Session. He was also prominent in educational matters, was made lord rector of King's College, Aberdeen, in 1857, and of Glasgow University in 1865, and was chancellor of Edinburgh University (1869).

INGLIS, Sir JOHN EARDLEY WILMOT (1814-62). A British soldier, born in Nova Scotia. He entered the army as ensign in 1833, took part in the suppression of the rebellion in Lower Canada in 1837, and also in the Punjab campaign of 1848-49. It was as one of the defenders of Lucknow at the outbreak of the Indian Mutiny in 1857 that his most notable service was rendered. His regiment had taken refuge in Lucknow on July 1st of that year, and the city was besieged by the enemy in overwhelming numbers. When his superior officer, Sir Henry Lawrence, was wounded, Inglis took command and held out against the Sepoys until the relief of the city by Sir Henry Havelock. For this he was promoted to be major-general. In 1860 he was appointed to the military command of the Ionian Islands, which at that time were in the possession of Great Britain.

INGLIS, Sir WILLIAM (1764-1835). A British soldier in the Peninsular War. At the age of fifteen he entered the army as ensign, and in

1781 went with his regiment to America, where he remained for ten years. In 1793 he returned to England. He took part in the campaign in Flanders, and three years afterwards served with distinction at the capture of Saint Lucia. As commander of the First Battalion of the Fifty-seventh Regiment he went with it to the Peninsula in 1809, where he participated in the battles of Busaco and Albuera. At Albuera he commanded the Fifty-seventh, which behaved with the utmost gallantry and suffered severe losses. Inglis was severely wounded, but afterwards fought in several other engagements, including that at Ortez, in French territory, in 1814. After the war he was made a lieutenant-general and was knighted.

INGOLDSBY, ĭŋ′gôlz-bĭ, Sir Richard (?-1685). A British soldier. He was born in Buckinghamshire, and as a kinsman of Oliver Cromwell, naturally espoused the Parliamentary cause at the beginning of the Civil War. In 1645 he commanded a regiment which took part in several actions, and garrisoned Oxford. At that time he apparently sympathized with the radical faction, which was bent upon inflicting the extreme penalty upon Charles I. He was a member of the court which tried the King, and his signature was affixed to the death warrant. After Oliver Cromwell's death he at first heartily supported Richard Cromwell, but after the latter's short and weak protectorate was ended, Ingoldsby was quite willing to make terms with Charles II., and, having loudly asserted his unwilling participation in the trial and execution of the King, was exempted from the punishment suffered by the other regicides. During the interval in which General Monk was dictator, he arrested General Lambert and dispersed his soldiers. Charles II. conferred knighthood upon him. Ingoldsby was a member of Parliament during part of Cromwell's régime, sat in the Protector's House of Lords, and was also member for Aylesbury during most of the reign of Charles II.

INGOLDSBY LEGENDS. A well-known collection of legends, written by the Rev. Richard Harris Barham, under the pseudonym of Thomas Ingoldsby, originally published in *Bentley's Miscellany* and republished in three series from 1840 to 1852. The legends, in both prose and verse, are distinguished by quaint humor and originality, and the metrical portions by musical quality and flexibility. Among the best-known of the selections are "The Witches' Frolic" and "The Jackdaw of Rheims."

INGOLSTADT, ĭng′ôl-stât. An ancient fortified town of Bavaria, situated on the left bank of the Danube, 46 miles by rail from Ratisbon (Map: Germany, D 4). Its most noteworthy buildings are the fifteenth-century Frauenkirche, the old castle, and the old university buildings. The University of Ingolstadt was founded in 1472, and by the end of the sixteenth century, when it was a noted seat of Jesuit theology, had about 4000 students. It was transferred in 1800 to Landshut, and in 1826 to Munich. Ingolstadt contains a number of establishments for the manufacturing of ammunition, and a school of military engineering. Population, in 1890, 17,646; in 1900, 22,207, mostly Catholics. Ingolstadt existed as early as the ninth century. It received municipal rights at the beginning of the fourteenth century and was fortified in the first half of the sixteenth century. The town was besieged by Gustavus Adolphus in 1632, and its fortifications were destroyed by the French after a three months' siege in 1800. They were rebuilt during the first half of the nineteenth century.

IN′GOMAR THE BARBA′RIAN. A play by Maria Anne Lovell (1851), adapted from the German *Der Sohn der Wildnis* of Friedrich Halm.

INGOUF, ăɴ′gōōf′, François Robert, the Younger (1747-1812). A French engraver, born in Paris. He studied with J. J. Flipart, and became known principally as a vignettist. He executed several engravings after Raphael, Ribera, Bénazech, and Le Barbier, and made portraits of Rousseau, Marivaux, Flipart, and others.

INGRAHAM, ĭn′grā-*a*m, Duncan Nathaniel (1802-91). An American naval officer, born in Charleston, S. C., the son of a Nathaniel Ingraham who served under John Paul Jones in the *Bon Homme Richard*. In 1812 he was appointed a midshipman in the United States Navy, and served through the second war with Great Britain. In 1825 he became a lieutenant, and in 1841 a commander. He was one of the officers in Commodore David Porter's expedition against the Caribbean pirates, and soon after the close of the Mexican War he was placed in command of the *Saint Louis*, on the Mediterranean station. His firm stand against the attempt made by Austria to seize Martin Koszta, who had participated in the Hungarian Revolution of 1848, and had taken steps toward becoming a citizen of the United States, was supported by the United States, and aroused great popular enthusiasm. (See Koszta Affair.) In 1855 he was commissioned captain, but at the outbreak of the Civil War he resigned from the service, and became chief of the Bureau of Ordnance, Construction, and Repair of the Confederate Navy, in which he rose to the rank of commodore.

INGRAHAM, Joseph Holt (1809-60). An American novelist, born at Portland, Maine. He went to sea when he was a boy, served in South American revolutions, and after graduation at Bowdoin in 1832 became a teacher in Natchez, Miss. His *The Southwest by a Yankee* (1836) was a great success, and was quickly followed by sensational volumes like: *Lafitte; Burton, or the Sieges; Captain Kyd; The American Lounger* (1839); and *The Hunchback and the Roué* (1843). In 1855 he took orders in the Episcopal Church, and settled at Holly Springs, Miss., where he wrote his popular biblical series, including: *The Prince of the House of David* (1855); *The Pillar of Fire* (1859); and *The Throne of David* (1860).

INGRAILED. See Engrailed.

INGRAM, ĭn′gr*a*m, John Kells (1823—). An English economist and Positivist, born in Donegal, Ireland, and educated at Trinity College, Dublin. He was fellow there (1846), professor of oratory and English literature (1852), regius professor of Greek (1866), and librarian (1879). He wrote: *A History of Political Economy* (reprinted, 1888, from the *Encyclopædia Britannica*); *On the Present Position and Prospects of Political Economy* (1878); *Outlines of the History of Religion; History of Slavery and Serfdom* (1888); *Sonnets and Other Poems*

(1900); *Passages from the Letters of Augustus Comte* (1901); and edited the earliest English translation of *The Imitation of Christ*, from the manuscripts at Dublin and Cambridge (1893).

INGRASSIA, ĭn′grȧs-sē′ȧ, or **INGRASSIAS**, GIOVANNI FILIPPO (1510-80). A Sicilian anatomist, born at Palermo. The plague at Palermo in 1575 was checked largely by his methods and through his work. He made discoveries of great importance in anatomy, and described them in his *In Galeni Librum de Ossibus Doctissima et Expertissima Commentaria.* He published several other interesting works.

INGRES, ăN′gr′, JEAN AUGUSTE DOMINIQUE (1780-1867). A French historical and portrait painter, a leader of the Classicists. He was born at Montauban, August 29, 1780, the son of a sculptor. He soon became the most important pupil of David, whose school he entered in 1796. In 1801 he received the Prix de Rome with the picture "Achilles Receiving the Messenger of Agamemnon," now in the Ecole des Beaux-Arts; but, owing to the state of the national finances, he was compelled to remain at Paris. He occupied himself with drawings, portraits, and mythological subjects until 1806, when he was sent to Rome. There he learned to know the works of Raphael, who exercised a dominating influence upon him. He also studied the antique fresco and vase painting, and these new influences brought him into conflict with the strict Classicists. While he continued to execute large historical pictures, he was compelled to earn his living by drawing those admirable crayon portraits—three hundred in number—which are perhaps the most extraordinary of his works. In 1820 he migrated to Florence, laboring under the same difficulties until, in 1824, the brilliant success of his "Vow of Louis XIII." (now in Montauban Cathedral) caused him to return to Paris.

He soon became the head of a large school and the acknowledged leader of the Classicists, hard pressed by the Romanticists, under the leadership of Delacroix. In 1829 he completed his "Apotheosis of Homer," a decoration of one of the ceilings of the Louvre, which is considered his finest epic painting. Weary of the hostile criticism which this painting provoked, he gladly became director of the French Academy at Rome in 1834, remaining there until 1841. During his second stay at Rome he painted two of his most admirable works, "Stratonice" and "Cherubini Inspired by the Muse" (Louvre), which were received with the highest praise. On his return to Paris in 1841, he was made an officer of the Legion of Honor, a commander in 1845, and grand officer in 1855; he was named a Senator on May 25, 1862; and he was soon after appointed a member of the Imperial Council of Public Instruction. At the Paris Exhibition of 1855 a room was set apart for his pictures, and one of two grand medals of honor was awarded to him, Delacroix getting the other. "La Source," sent to the London Exhibition of 1862, and now in the Louvre, showed powers unimpaired by age. He died in Paris, January 17, 1867.

Ingres's greatest strength lay in his drawing. "*Le dessin c'est la probité de l'art*" was his motto. His consummate skill is very evident in his admirable crayon studies and drawings, of which the Montauban Museum contains the most valuable collection, left by the painter to his native town. To him more than to any other the French school owes that excellency of draughtsmanship for which it is famous. His studies also show an incredible perseverance and sincerity of purpose. These qualities, however, were attained at the expense of color, which, when not almost monochrome, was coarse and hard. His works also show lack of originality. The figures, even of his best paintings, may be traced to models in works of Raphael, Michelangelo, or Greek vase painting.

Among the most important historical paintings of his first Roman period are: "Œdipus and the Sphinx" (1810), in the Louvre; "Jupiter and Thetis" (1811), Aix Museum; the "Sleep of Ossian" (1811), and "Romulus Conquering Acron" (1812), frescoes for Napoleon's palace on the Monte Cavallo; the "Odalisque" (1814), Louvre; "Virgil Reading the *Æneid* to Augustus;" "Pedro of Toledo Kissing the Sword of Henry IV." (1814); "Raphael and the Fornarina" (1814); "Aretino and the Envoy of Charles V." (1816); "Roger and Angelica" (1819), and "Christ Delivering the Keys to Saint Peter" (1820), both in the Louvre. His later works include: "Martyrdom of Saint Symphorian" (1834), Autun Cathedral; "Madonna with the Host," Saint Petersburg; "Christ Among the Doctors" (1842); "Birth of Venus" (1848); "Aretino Visiting Tintoretto" (1848).

Ingres is, perhaps, greatest in portraiture, where he stands in closest contact with nature. Among the best of his painted portraits are those of himself (1804); "Napoleon as First Consul" (1804), Liège Museum; "Napoleon Enthroned," Hôtel des Invalides (1806); "Lemoine" (1819); "Charles X." (1829); and especially "Bertin the Elder" (1833). The Louvre contains those of "Philibert Rivière and Wife" (1806) and of "Cherubini" (1843). Ingres also designed cartoons for the celebrated glass paintings in the Chapel of Saint Fernando, Paris. His works were admirably engraved, especially by Richehomme and Henriquel-Dupont. The most important of his large school of pupils was Hippolyte Flandrin (q.v.).

Consult the biographies of Ingres by Blanc (Paris, 1870); Delaborde (ib., 1870); Balze (Paris, 1880); Mommeja, in *Les artistes célèbres;* Schmarson, in Dohme, *Kunst und Künstler* (Leipzig, 1884).

INGULF, ĭn′gōōlf, RUDOLF (known as INGULF VON KÖLN) (1727-85). A German sculptor and traveler, the first to appreciate the nature of California's mineral resources. He was born in Cologne, established a factory in 1751 in Mexico, and by its profits was soon enabled to undertake his scheme of travels. He visited unexplored parts of Mexico, proceeded to New Granada, and then went north again into central California. His books on the geology of California, though they were of considerable scientific value, attracted little attention. He won more of a reputation as a sculptor than as an explorer and writer. The busts of Columbus, Pizarro, and Velazquez are among his best pieces. He published *Lehrbuch der Geographie von Californien* (1771); *Reisen in Neu-Spanien* (1772); *Die geologischen Formationen von Californien* (1775); and *Kosmographie von Amerika* (1779).

IN'GULPH (c.1030-1109). Abbot of Crowland or Croyland, Lincolnshire. He is supposed to have been born in London about 1030, and to have studied at Oxford. He became a favorite of Edgitha, the wife of Edward the Confessor; visited Duke William of Normandy at his court in 1051 and became his secretary. After a pilgrimage to the Holy Land he entered a Norman monastery. Here he remained till 1086, when he was invited to England by the Conqueror, and made Abbot of Crowland, where he died November 16, 1109. The *Historia Monasterii Croylandensis* (printed by Savile in London in 1596, and in more complete edition by Fulman, at Oxford, in 1684; translated into English for Bohn's Antiquarian Library by Riley, 1854), was long attributed to him. In 1826 Sir Francis Palgrave, in an article in the *Quarterly Review*, and in 1862 H. T. Riley in the *Archæological Journal*, maintained by cogent arguments that the whole so-called history was little better than a novel, and was probably the composition of a monk in the thirteenth or fourteenth century. These conclusions have been almost universally adopted.

INHALATION (from Lat. *inhalare*, to inhale, from *in*, in + *halare*, to breathe). In medicine, a term used to signify the receiving into the lungs of vapors or gases for producing anæsthesia, or for curative purposes. The ordinary manner of administering chloroform is as follows: Over a skeleton wire pan, the size and shape of a small deep saucer, a flannel bag is drawn. Chloroform is dropped on the bag, and the contrivance is inverted over the patient's nose and mouth. To give ether, a large square nose-bag is made by folding fairly strong paper inside of a towel and then doubling the double fabric together and fastening it with safety pins. Less wasteful and more exact in the amount used, as well as vastly more elegant, are the regular inhalers, apparatus designed for the purpose and made of metal and rubber. Such an apparatus is necessary for the administration of nitrous oxide, or 'laughing gas.' (See ANÆSTHESIA.) The vapor of hot water is employed in throat diseases, often affording great relief; and medicinal substances, such as benzoinol and camphor, are sometimes used in conjunction, but it is often desirable to use the watery vapor without any combination. A very convenient and, in the absence of other apparatus, the only available way, is to place a funnel over an open vessel containing hot water, and inhale the hot vapor through the spout. A deep vessel, such as a two-quart earthen pitcher, may be used, containing a pint of boiling water—the patient breathing from the open mouth, putting his face close over the vessel, with care to moderate the heat of the contents. The vapor of carbolic acid is often beneficial as an inhalant, and may be administered in a similar manner. There are various kinds of apparatus for inhalation, with the common object of introducing vapor to the lungs in the proper strength or temperature, and due admixture of air. Oxygen is administered by inhalation in many diseases, especially in anæmia and pneumonia. It is given from a cylinder from which it escapes as regulated by a cork, passing through a 'wash-bottle' containing water before it reaches the tube, or inhaler, held in the patient's nostril or mouth.

INHAMBANE, ĕ'nyȧm-bä'nȧ. An important seaport town in Portuguese East Africa, situated on Inhambane Bay, in latitude 23° 50′ S. (Map: Africa, H 7). Its harbor admits of vessels of considerable draught, and its trade in wax, copal, and rubber amounts to about £250,000 ($1,250,000) annually. Its population is estimated at 3500.

INHERITANCE (OF. *enheritance*, from *enheriter*, *inheriter*, to inherit, from Lat. *inhereditare*, to appoint as heir, from *in*, in + *heres*, heir; connected with *herus*, master, Gk. χείρ, *cheir*, hand, Skt. *har*, to take). In the most general sense, the acquisition of property, either real or personal, whether by will or intestacy, through the death of the former owner. In the more restricted sense of the English and American law, however, the term is confined to the transmission of real property by descent only. The popular use of the term to describe gifts by last will and testament is wholly inaccurate. Personal property does not in any event pass by inheritance, but upon the death of the owner intestate goes to his personal representatives for purposes of administration (q.v.) and distribution (q.v.).

Strictly speaking, therefore, inheritance is confined to certain kinds of interests in land which have come to be known as estates of inheritance. (See ESTATE.) These include the two classes of estates known as fee simple and fee tail. In the former the inheritance is unrestricted, or 'general,' as it is termed, being open to all persons standing in any degree of consanguinity to the decedent, collateral as well as lineal. In the latter the inheritance is restricted to the issue of the interstate, or even to a special class of lineal descendants, as to the issue of a certain wife begotten, or even to the male or the female issue. (See FEE TAIL.) This quality of inheritability, now regarded as an essential attribute of the absolute ownership of real property, has not always been a characteristic of such estates; but, like the corresponding quality of alienability, was gradually added to the fee as that existed under the feudal system of land tenure. For the rules governing inheritance, see DESCENT and HEIR.

The term inheritance is also frequently employed to describe the property or estate acquired by descent. This may, in addition to the real estates of inheritance above described, include also certain privileged chattels, known as heirlooms (q.v.). Consult the authorities referred to under DESCENT.

INHERITANCE TAX. A charge or assessment on the succession or devolution of property from a deceased person to his heirs or legatees.

Such taxes were imposed in Rome over two thousand years ago, and, in some form, have been a source of revenue in several of the Continental countries of Europe almost since their organization as independent governments. In England Gladstone called the various inheritance tax charges 'death duties,' and the name has since come into common usage. (See further under DEATH DUTIES.) The colonies of Great Britain, particularly Australia and New Zealand, have followed her example, and 'death duties' are one of the chief sources of revenue in those progressive commonwealths. Taxes of a similar character were imposed by the United States Government as a part of its internal revenue system during the Civil War, and were repealed some time after its close. However, in some form or other, this form of taxation is imposed in a number of the United States.

The form, rates, and method of assessment and collection of such taxes vary considerably in different States and countries. There are, however, certain general characteristics common to most jurisdictions. Such laws sometimes provide for a progressive rate according to the amount of property of the estate, also a graduated rate according to the degree of relationship of the individuals entitled thereto.

In some jurisdictions the portion to which a widow or minor children become entitled is exempt up to a certain amount, and lineal descendants are favored in preference to collateral relatives whenever any distinction is made.

Lineal, collateral, and succession inheritance taxes have been established in the following States: Connecticut, 5 per cent. on all sums over $1000; Delaware, a graduated scale of from 1 to 5 per cent., according to amount and degree of relationship; Illinois, 1 per cent. on values over $20,000 to lineal descendants, 2 per cent. to 5 per cent. on all amounts to collateral relatives; Maryland, 2½ per cent. on all successions; New York, 1 per cent. on all property of value of over $10,000 to lineal heirs, 5 per cent. on all amounts or values over $500 to collaterals; Ohio, 5 per cent. on values over $500; Virginia, 5 per cent. on all amounts. The following States have collateral inheritance tax laws only: California, 5 per cent. on amounts over $500; Maine, 2½ per cent. on amounts over $500; Massachusetts, 5 per cent. on amounts over $5000; Minnesota, a 5 per cent. graded tax; New Jersey, 5 per cent. on amounts over $500; Tennessee, 5 per cent. tax on all amounts; West Virginia, 2½ per cent. on all property.

The English death duties (q.v.) are graduated from 1 per cent. to 10 per cent., according to amount and degree of relationship of heirs. The Canadian provinces have followed the English statutes closely, both as to rates and substance. On the Continent, Germany, Austria, France, Switzerland, Holland, Russia, Italy, Spain, Portugal, Greece, Denmark and Sweden have inheritance or succession taxes.

The laws providing for such taxes have occasioned a great deal of discussion and litigation. Their constitutionality has been bitterly attacked in several States, the contestants claiming that they do not provide a uniform method of taxation affecting all persons alike, as required by the constitutions of most States, but this contention has been repudiated by the courts of most of these jurisdictions. These decisions have proceeded on the ground that such a tax is equally imposed and properly apportioned upon all classes; that it is a tax on the succession or devolution of property, rather than property itself, and is, therefore, uniform in its operation and effect. Death-bed gifts, made obviously to escape such charges, are usually included within the scope of these laws. The justice and convenience of this form of taxation have appealed to most economic writers, and it is rapidly growing in popular favor. See DEATH DUTIES; INHERITANCE; SUCCESSION; TAX AND TAXATION. Consult the authorities referred to under these titles, and also Tristam and Coote, *Probate Practice* (London, 1900); Dos Passos, *Collateral Inheritance, Legacy, and Succession Taxes* (2d ed., New York, 1895).

INHIBITION (Lat. *inhibitio*, from *inhibere*, to hold back, from *in*, in + *habere*, to hold). A term used in physiology to denote a prevention or restraining action. Inhibition in a nervous mechanism is a resistance to disordered or excessive action. An inhibitory nerve is one which controls the organ or other structure to which it goes, preventing undue functional activity.

INHIBITION, WRIT OF. A writ or process directed to an individual forbidding him to do some particular act. It is derived from the civil law, where it was employed by the Courts of Appeal to stay the execution of judgments by inferior courts, during the pendency of the appeal. The writ was used in the early English law for the same purpose, but was later superseded by the writ of prohibition. The term is practically obsolete.

IN HOC SIGNO VINCES (Lat., In this sign thou shalt conquer). The legend on a flaming cross which, according to tradition, appeared in the sky to the Roman Emperor Constantine I. before his battle with Maxentius.

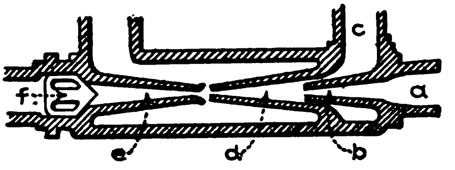
IN'IA. A cetacean of the family Platanistidæ, and thus related to the susu of the Ganges, which inhabits the Amazon and its larger tributaries. Only one species (*Inia Geoffrensis*) is known. It reaches a length of eight feet, and may be wholly pink in color, or a varying mixture of black and pink. The Indians regard it with mingled fear and superstition, and it is hard to learn what are its true habits.

INIOMI, ĭn'ĭ-ō'mī (Neo-Lat. nom. pl., from Gk. *ἰνίον*, *inion*, muscle at the back of the shoulder + *ὦμος*, *ōmos*, shoulder). An order of teleost, soft-rayed, deep-sea fishes, which are closely allied to the Isospondyli, but lack the mesocoracoid, and have an imperfect connection between the shoulder-girdle and the cranium. It consists of several families of fishes dwelling in the oceanic abysses, most of which have phosphorescent light-organs or photophores. (See LANTERN-FISH.) Consult Jordan and Evermann, *Fishes of North and Middle America* (Washington, 1896). See ISOSPONDYLI.

INJALBERT, ăN'zhȧl'bâr', JEAN ANTOINE (1845—). A French sculptor, born at Béziers. He was a pupil of Dumont and won the Prix de Rome in 1874. His works include a bas-relief of the "Temptation" (1877); "Christ," a notable dramatic figure in the Rheims Museum; the "Titan" on a fountain at Béziers (1884); statues of "Grief," "Renown" (1888), and "Melancholy" (1891); "Hippomène," in the Luxembourg; groups in the Prefecture at Montpellier, decorative groups at the Exposition of 1900, and some portrait busts. His work is marked by vigor and originality.

INJECTION (Lat. *injectio*, from *injicere*, to throw in, from *in*, in + *jacere*, to throw). A term applied in medicine to a fluid thrown into the passages or cavities of the body by means of a syringe or elastic bag. The fluids thus injected into the rectum or lower bowel are termed enemata (q.v.). The injection of a dilute solution of salt into the veins has been in use since about 1879, and has been found to be of great service in many diseased conditions. The injection of blood into the veins is described in the article TRANSFUSION OF BLOOD. See HYPODERMIC MEDICATION.

INJECTOR (from Lat. *injicere*, to throw in). An instrument for forcing water into a boiler, in which a jet of steam mingles with and forces a continuous jet of water into the same boiler against its own pressure. There are numerous forms of injectors, the chief differences between which consist in the relative proportions of the parts and in the means employed for changing these proportions, either automatically or otherwise, so as to adapt the instrument to the variation of steam or water supply. The accompanying diagram indicates the interior arrangement of the simplest form of injector. Steam from the boiler passing through the pipe *a* enters the receiving tube *b*, where it is joined by the water which enters the pipe *c*. The water condenses the steam in the combining tube *d*, and a water-jet is formed which enters the delivery tube *e* and thence past the check valve *f* into the boiler below the water-line. The operation of the injector is difficult to explain in popular terms. Briefly stated, however, steam escaping from under pressure has a much higher velocity than water would have under the same pressure and condition. The escaping steam from the receiving tube unites with the feed water in the combining tube, and gives to this water a velocity greater than it would have if escaping directly from the water-space in the boiler. The injector was invented by Henri Jacques Giffard, a French mathematician and engineer, and is the most popular boiler-feeder now in use; practically every locomotive engine boiler is fed by injectors. The history of the development of the injector, the principles of its action and descriptions of representative forms, are given in Kneass, *Practice and Theory of the Injector* (New York, 1898).



SECTION OF INJECTOR.

INJUNCTION (Lat. *injunctio*, from *injungere*, to command, from *in*, in + *jungere*, to join; connected with Gk. ζευγνύναι, *zeugnynai*, Skt. *yuj*, to join, and ultimately with Eng. *yoke*). A judicial writ or process of a court of equity, commanding a person or persons named therein to do or not to do a particular thing. It had its origin in the Roman law, under which system a somewhat similar process, known as an interdict, was employed. The idea was introduced into England and Scotland by the early Chancellors, as a result of their search for remedies to modify the harshness of the common law and to supplement it where inadequate to meet the ends of justice. In Scotland the remedy is still called an 'interdict.' The scope of its use and application has greatly widened until to-day it is perhaps the most important remedy of an equitable nature.

The purposes for which an injunction may be employed may be described generally as follows: (1) To prevent the commission of certain wrongs of a civil nature; (2) to protect rights; (3) to compel the restoration of rights. The greatest proportion of injunctions fall under the two classes first named, and are usually termed *preventive*, because they operate to prevent wrongs by restraining acts, while the third class, called *mandatory*, as descriptive of their purpose to compel the affirmative performance of an act, are more rarely used. A common example of a preventive injunction is one to restrain the continuance of a nuisance, such as generating unusual quantities of black smoke and cinders in a great city; whereas one to compel the restoration of running water to its natural channel by a person who has wrongfully diverted it therefrom would be classed as mandatory. A railroad which has wrongfully laid tracks without first getting the right of way may be compelled to remove them by one of the latter class of injunctions. Some other important uses of preventive injunctions are: To prevent the violation of contracts, as a contract not to sing for any one except the other party to the contract; to restrain or prevent waste, or nuisance; to protect patent rights, copyrights, and trademarks from infringement; and to stay proceedings in a court of law. The latter object is effected by enjoining one or both of the parties to the action from proceeding further in the cause. The injunction does not seek to oust the court of law of its jurisdiction or to restrain the judge in the exercise of his judicial functions. The prerogative will be exercised in this way only when the prosecution of the action or the enforcement of a judgment will result inequitably to one of the parties. Where equitable defenses are permitted in a legal action, as in New York, there is seldom reason for such interference. A court of equity will sometimes enjoin a party or parties, within its own jurisdiction, from prosecuting an action in another jurisdiction. A notable example of such exercise of power is where a United States court restrains all creditors prosecuting actions in State courts for the enforcement of their claims against a bankrupt from proceeding further in their actions, thus leaving all matters relating to his estate to its own determination.

A court of equity follows the same rules in this summary method of procedure as in the exercise of its other functions, and therefore will only grant an injunction when the remedy at law will be inadequate to give a party who is wronged the complete relief to which he is entitled. One reason for issuing an injunction is to prevent irreparable damage. Where, for example, a person maintains an offensive nuisance which operates to keep away customers from a near-by shop, the shopkeeper could recover damages in a court of law, but, as a long delay may ensue before his cause can be reached, his business may be ruined in the meantime. His damages, in that event, would be hard to estimate, and the wrongdoer might be financially irresponsible, and, therefore, that relief would be manifestly inadequate to protect him; whereas, if the nuisance is immediately abated, in compliance with an injunction order, he is saved irreparable damage. Much criticism and controversy has been occasioned by the class of cases where the courts have enjoined labor agitators and sympathizers from inducing or coercing contented workingmen to strike, for the purpose of inflicting injury and damage on their employers, and thereby forcing them to grant the concessions demanded by their organizations. This has been called 'governing by injunction,' and has been denounced by such leaders and some publicists as an unwarranted new and arbitrary exercise of power by the courts. This contention is not supported by legal authority, as the right to conduct one's business without interference or molestation from others in any manner is a long-established privilege of citizenship, the violation of which is an actionable wrong at law, and the jurisdiction of a court of equity to prevent wrongs and injuries to persons and their property and to restrain combinations and conspiracies for unlawful purposes has always been exercised and has never been questioned by any court, State or Federal, since the organization of our judicial system. The English authorities are to the same effect. Of course, the *crux* of the question in all these cases is, what constitutes an interference or molestation of another's business within the meaning of the law; and upon this point opinions are widely divergent.

The courts have not defined or limited the circumstances in which relief by injunction will be granted, but reserve the right to exercise their power whenever a novel state of facts may seem to present urgent equitable grounds for doing so.

With reference to the time when they are granted and remain in force, injunctions are also classified as *preliminary* or *interlocutory*, and *perpetual*. Where there is danger that great damage will be done by one party to another before the questions between them can be determined on their merits, a court of equity, or judge thereof, may, on application of one party to him on the bench, or at chambers, at any time of the day or night, and without notice to the other party, grant an injunction to prevent the continuance of the wrongs complained of during the pendency of the action; or, if no action has been commenced, to operate as a stay until an application is made to the court by the party enjoined to have it dissolved. Upon such application all the facts on both sides are presented to the court, and it may then dissolve the injunction or make it permanent. In order that the party thus summarily enjoined may not suffer damage if it is finally determined that he was within his rights in doing the acts complained of, the court or judge requires the party seeking the relief to give sufficient security that he will pay all damages that his adversary may sustain by reason of the injunction if it is thereafter dissolved for lack of sufficient legal grounds to sustain it. This procedure thus protects both parties. This temporary, or interlocutory, injunction may be made perpetual if the court later determines that the grounds advanced for its continuance are valid in law and have been sustained by the proof. No security is required upon the granting of a perpetual injunction. As the order is directed to the person affected thereby, disobedience thereof is punished as a contempt of court (q.v.). See CHANCERY; EQUITY.

Consult: High, *Treatise on the Law of Injunctions as Administered in the Courts of the United States and England* (3d ed., Chicago, 1890); Kerr, *Treatise on the Law and Practice of Injunctions* (4th ed., London, 1902); Beach, *Treatise on the Law of Injunctions* (Chicago, 1895).

INJURY (from Lat. *injuria*, harm, from *injurius*, acting wrongfully, from *in-*, not + *jus*, right, law). In the legal sense of the term, an actionable wrong; that is, any act in violation of the rights of another of which the law will take cognizance by allowing the injured party an action against the wrongdoer to recover specific property or damage, or both. In the practical sense the term may also be said to embrace actionable wrongs against the State, in which case the result sought by the action brought by or on behalf of the State is the punishment of the offender. Injury, in the legal sense, is to be distinguished from wrongs which are *damnum absque injuria*, that is, acts resulting in harm to another for which the law gives no remedy.

An injury may also be *injuria absque damno;* that is, an injury which, although a technical invasion of a right, is without actual damage to the injured party. (See DAMAGES.) The principles governing the law of civil or private injury are discussed at length under the subject of TORT and under EQUITY, which exercised its preventive jurisdiction over torts. See, also, JUSTICE; CONTRACT; TROVER; TRESPASS. The principles governing the law of public wrongs are discussed under CRIME; LAW, CRIMINAL.

INK (OF. *enque*, *enche*, Fr. *encre*, Prov. *encaut*, It. *enchiostro*, ink, from Lat. *encaustum*, Gk. *ἔγκαυστον*, *enkauston*, purple ink, from *ἔγκαυστος*, *enkaustos*, burned in, from *ἐγκαίειν*, *enkaiein*, to burn in, from *ἐν*, *en*, in + *καίειν*, *kaiein*, to burn). Any colored fluid used in writing or printing. The use of ink for writing was known to the ancients, and papyri and manuscripts dating back to more than 4000 years ago are to be found in various museums. Many of these writing-fluids were pigments, consisting chiefly of various forms of carbon, such as ivory-black, lampblack, and soot mixed with gum, in order to avoid too great fluidity; others were apparently actual dyes of iron and acids, to which carbon was added. The liquor of the cuttlefish is reported by Cicero and Pliny to have been used among the Romans as a writing-fluid. Elegant manuscripts, written in gold and silver inks, are well known, and among these may be mentioned the celebrated *Codex Upsal*, which is written in silver ink on violet parchment, the initials and certain passages being in gold. Some written wholly in red ink, made of vermilion, purple, or cinnabar, are still preserved, although red was more frequently used for the headings and initials of books, chapters, and pages. The emperors of Constantinople were in the habit of signing their acts in red ink, and the first secretary was guardian of the vase containing the cinnabar, or vermilion, which the Emperor used. Green ink, though rarely found in charters, often occurs in Latin manuscripts, especially those of later years. It was also used by the guardians of the Greek emperors before their wards attained their majority.

Inks are commonly treated under the two heads of writing-ink and printing-ink.

BLACK WRITING-INK. Ordinary black writing-ink is a compound obtained by the action of ferrous sulphate on an infusion of nutgalls or any similar compound containing tannin, and is essentially a ferroso-ferric gallate. Typical of this kind of ink is the one consisting of the following ingredients: nutgalls, 12 pounds; ferrous sulphate, 5 pounds; gum Senegal, 5 pounds; and 12 gallons of water. It is prepared by carefully selecting nutgalls, preferably the variety from Aleppo, as that contains a larger proportion of gallic and tannic acids than other varieties, which are then crushed and treated with distilled water for several days, after which the clear liquid is carefully drawn off and to it is added a clear mucilage, made by previously dissolving the gum in hot water and filtering. Finally, dissolve separately the ferrous sulphate and mix with the foregoing solutions. Some authorities recommend instead of a solution of ferrous sulphate that clean iron filings be added to a portion of nutgalls and gum and the liquid agitated until it becomes deep black in color. In either case the color is due to the oxidation of the iron salt and its combination with the gallic acid in the solution. In the manufacture of commercial inks, nutgalls are frequently substituted by logwood, oak bark, and sumach. It has been determined that the proportion of three parts of the galls to one part of the ferrous sulphate yields a satisfactory ink, but in actual practice more ferrous sulphate is usually added. The use of the foregoing ingredients has been conceded to result in the production of a writing fluid which is jet black at the time of use, flows freely in the pen, and is practically permanent. In order to obtain a deeper black, logwood and indigo extracts are sometimes added. Runge in 1849 described a chrome ink which he made by adding one part of potassium chromate to one thousand parts of a solution of logwood, made by exhausting one pound of logwood with 6 quarts of boiling water. The potassium chromate is added gradually when the solution is cooled, the mixture being constantly stirred during the addition. This ink is cheap, permanent on paper, and unaffected by exposure to water or acids. The use of ammonium vanadate, with an infusion of nutgalls, has been recommended as producing an exceedingly black writing-fluid, but the expense of the vanadium salt has prevented its common use. Certain aniline blacks, especially nigrosin, owing to their fluidity, and the fact that they form no sediment, have been extensively used in fountain pens.

RED WRITING-INK. Red inks are commonly prepared from Brazilwood, cochineal, or carmine; those made from Brazilwood are regarded as more permanent, while those from cochineal yield the most brilliantly colored fluids. An excellent quality of red ink may be had by boiling 2 ounces of Brazilwood in 32 ounces of water and by adding to that solution, after straining, one half an ounce of stannous chloride (tin salt) and 1 dram of gum arabic. This mixture is then boiled down to a pint. The modern red ink is frequently little more than a solution of some aniline color, such as eosin red or rosein.

BLUE WRITING-INK. Ordinary blue ink is a preparation of Prussian blue, and may be made by triturating 6 parts of this substance and 1 part of oxalic acid with a little water to a perfectly smooth paste, and diluting the mass with a sufficient quantity of distilled water. An excellent blue ink is made by dissolving soluble Paris blue ("cornflower blue") in alcohol.

ANILINE WRITING-INKS. The general formula for making aniline inks is to dissolve 15 parts of any aniline color in 150 parts of strong alcohol in a glass vessel, and, after allowing the solution to stand for three hours, adding 1000 parts of distilled water; the liquid is then heated gently for some hours, or until the color of the alcohol has quite disappeared, whereupon it is mixed with a solution of 60 parts of powdered gum arabic in 250 parts of water. This formula may be followed for the ordinary violet or purple ink, as well as for the many other colors, such as green, yellow, etc., which are sometimes used.

METALLIC INKS. Gold, silver, and similar metallic inks may be made by taking equal parts of the metal in leaf and triturating with honey until the metal is reduced to the finest possible state of division; then agitating with 30 parts of hot water, allowing to settle, decanting the water, repeating the washing several times, and finally drying the metal and mixing it with a little weak gum arabic water for use.

SPECIAL INKS. Copying-ink is made by adding a thickening substance, such as gum arabic, gum dextrin, or glycerin, to ordinary ink. The ordinary marking or indelible inks are made by dissolving a silver salt, usually the nitrate, in water and ammonia, to which a small quantity of gum is added. Such inks may be removed by treatment with potassium cyanide. More permanent inks may be made by using solutions of gold or platinum chloride.

SYMPATHETIC OR SECRET INKS. These are fluids which produce colorless writing upon paper; but, when the latter is subsequently exposed to heat or proper chemical action, the writing becomes colored and clearly readable. Among the favorite secret inks may be mentioned solutions of lead acetate, whose invisible marks on paper turn black on exposure to sulphureted hydrogen, owing to the formation of sulphide of lead. Cobalt nitrate solution furnishes another favorite secret ink, its marks on paper turning blue on treatment with oxalic acid. A solution of either cobalt chloride or the nitro-chloride will yield characters which are green when heated, but which disappear on cooling; also a weak solution of nickel and cobalt chlorides will produce green tracings.

INK-POWDERS. These are nothing but the common constituents of ink in a dry state. Black ink-powder may be made by mixing 4 parts of powdered nutgalls, 2 parts of ferrous sulphate, and one part of gum arabic. The dry aniline colors may be similarly used.

PRINTING-INKS. Any ink used in printing is essentially a pigment of the required color, mixed with an oil or varnish. John Underwood in 1857 before the Society of Arts described the properties essential to a good printing ink as follows: It must distribute freely and easily and work sharp and clean; it must not have too much tenacity for the type, but come off freely and adhere to the paper; it must dry almost immediately on the paper, and not dry at all on the type or rollers; it should be practically proof against the effects of time and chemical reagents, and never change color. The pigment used for the best black ink is lampblack, and the vehicle is usually linseed oil. Mineral pigments are generally used to produce the different colored printing-inks. Details concerning the manufacture of printing-inks may be found in any of the larger handbooks on printing. In lithography, the writing-ink for drawing on the stone may consist of equal parts of tallow, wax, soap, and shellac, mixed up with a sufficient quantity of Paris black. The printing-ink used to take the impression of engraved plates, with a view to transference to the stone, may consist of equal parts of tallow, wax, soap, shellac, and pitch.

Consult: Spon, *Workshop Receipts* (London, 1883); Lehner, *Tintenfabrikation* (Vienna, 1885); Schluttig and Neumann, *Die Eisengallustinten; Grundlagen zu ihrer Beurteilung* (Dresden, 1890); Naquet, *Legal Chemistry*, trans. by Battershall (New York, 1876); Frazer, *Bibliotics, or the Study of Documents* (Philadelphia, 1901).

INKBERRY, or WINTERBERRY (*Ilex glabra*). An evergreen shrub 2 to 4 feet high, which belongs to the holly family (Ilicinæ), and which is found upon sandy soils in the United States from Massachusetts to Florida. The leaves are dark green, an inch or more long, wedge-lanceolate or oblong, smooth and shining on the upper surface; the sterile flowers in clusters of from 3 to 6, fertile ones solitary and followed by small black berries. Its leaves and bark were formerly used as a remedy in intermittent fever. Its principal use is for decoration, as a constituent in bouquets, for which purpose it is shipped to New York and Philadelphia from southern New Jersey. Sometimes it takes the place of the American holly (*Ilex quercifolia*), but it is not so ornamental.

INKCAP (*Coprinus atramentarius*). An edible toadstool. See MUSHROOM.

INKERMAN, ĭn'kẽr-măn'. A village in the Crimea, situated near the eastern extremity of the harbor of Sebastopol. It is memorable as the scene of a battle during the Crimean War between an army of Russians 60,000 strong, and detachments of the allied forces, consisting of about 14,000 troops actually engaged. At about 5 o'clock on the morning of November 5, 1854, the Russians, who had marched from Sebastopol, concealed by the darkness and a thick, drizzling rain, appeared crowding up the slopes of the plateau on which the Allies were posted. Here a portion of the English Royal Guards made an heroic stand for six hours against a body of Russians that was probably five times as numerous. When victory seemed almost assured to the Russians, French reënforcements came up to the aid of the British, and by a splendid charge drove the enemy off the field.

IN'KLE AND YAR'ICO. A drama by George Colman the younger, produced in 1787. The plot, which is taken from the *Spectator*, No. 11, is the story of a young Englishman lost in the Spanish Main, who falls in love with an Indian maiden, whom he sells as a slave when he is rescued.

INLAND BILL. See BILL OF EXCHANGE.

INLAYING. The art of decorating flat surfaces by the insertion of similar or different materials of a different color. It is usually made level with the surface, but sometimes in slight relief. When wood of one color is decorated by inlaying with others of different colors, the term 'marquetry' (q.v.) is now generally applied. The art was well known to the ancients; it made great progress in Italy in the fifteenth century, where it was used in furniture, developing from the use of small geometric patterns into elaborate representations of architecture and figures—the so-called Tarsia work. During the sixteenth century it was introduced into France and Germany, where it attained high development during the eighteenth century. The French artist Charles André Boule (1642-1732) was celebrated for his use of tortoise-shell and brass, known as buhlwork—a new development of marquetry.

Metal of one kind is inlaid with other kinds, and often very beautiful effects are produced. When steel is inlaid with gold or brass, it is usually called damaskeen-work. One variety produced in India is called kuft-gori. In this the inlaid metal, usually gold, occupies more of the surface than the metal forming the ground. Another beautiful variety of Indian inlaying is called tutenague or bedery-work, which consists in making the article to be inlaid, most frequently a hookah-bowl, of an alloy consisting of copper one part to pewter four parts. This is hard, but is easily cut; the pattern is then engraved, and little pieces of thin silver cut to the desired forms are dexterously hammered into the spaces thus cut out to receive them.

In the art of stone-inlaying the Florentines have long held the palm; their favorite work is black marble, with inlaid figures of brilliant colored stones; this work is called pietra dura, or Florentine work. Very beautiful work of this kind is now made in the Imperial works at Saint Petersburg, where the art has of late been sedulously cultivated by the Russian Government. This was always a favorite art in Delhi and Agra, where some of the most exquisite work is still produced. It was, however, originally introduced from Europe by the French artist Austin de Bordeaux, who decorated the Taj Mahal. Usually, in the Indian work, white marble forms the groundwork, and the figures are formed of carnelian, jasper, agate, jade, lapis-lazuli, and other costly stones. No stone-inlaying has ever surpassed the inlaid marble walls of the celebrated Taj Mahal. The designs are very artistic, the execution almost marvelous, and the harmony of color produced by the different stones employed is most beautiful. Many other materials than those mentioned are used for inlaying; and there is a style of inlaid work in which small squares of colored stone, glass, or pottery are made to form pictorial and artistic decorations; this is called mosaic-work.

IN'MAN, GEORGE ELLIS (1814-40). An English song-writer. He was clerk to a firm of London wine merchants, but opium proved his ruin, and he killed himself in Saint James's Park. His best known songs are: *The Days of Yore* (1838); *Saint George's Flag of England* (1840); *Sweet Mary Mine; My Native Hills* (music by Bishop); and *Wake, Wake, My Love*, which was sung to a melody by R. A. Wallis, for whose opera, *The Arcadians*, Inman wrote the book.

INMAN, HENRY (1801-46). An American portrait, genre, and landscape painter. He was born at Utica, N. Y., October 20, 1801, and was a pupil of John Wesley Jarvis in New York City. He excelled in portrait painting, but was less careful in genre pictures. Among his landscapes are "Rydal Falls, England," "October Afternoon," and "Ruins of Brambletye." His genre subjects include "Rip Van Winkle," "The News Boy," and "Boyhood of Washington;" his portraits, those of Henry Rutgers and Fitz-Greene Halleck, in the New York Historical Society; of Bishop White, Chief Justices Marshall and Nelson, Jacob Barker, William Wirt, Audubon, De Witt Clinton, Martin Van Buren, and William H. Seward. During a year spent in

England in 1844-45, he painted Wordsworth, Macaulay, John Chambers, and other celebrities. He returned to America in failing health, and at the time of his death, January 17, 1846, was engaged on a series of historical pictures for the Capitol at Washington.

His son and pupil, JOHN O'BRIEN INMAN (1828—), a genre painter, was born in New York City, June 10, 1828. From the West, where he had gained a reputation as a portrait painter, he went to New York and opened a studio. His flower pieces and genre pictures were much admired. Since 1866 he has resided at Rome. He is noted for his pictures of Roman peasants.

IN MEMO'RIAM. A poem by Tennyson (1850), in memory of his friend Arthur Henry Hallam.

INN, In. An important tributary of the upper Danube, rising in the southern part of the Swiss Canton of Grisons, at an altitude of over 8000 feet (Map: Germany, E 4). It flows through the canton in a northeastern direction, traversing the valley of Engadine, and as a violent mountain torrent enters Tyrol through the Finstermünz Pass. It maintains its northeastern direction through Tyrol, where its valley is famous for its scenery, and turns north at Kufstein, a short distance below its entrance into Bavaria. At the town of Rosenheim the Inn increases considerably in volume, becoming broad and filled with islands, and at its confluence with the Danube at Passau it is wider than the main river. The total length of the Inn is about 320 miles. It becomes navigable at Hall, a short distance below Innsbruck, but its commercial importance is greatly detracted from by the rapidity of its course. Its chief tributaries are the Salzach and the Alz.

INN (AS. *inn*, *in*, house, chamber, from *in*, within, Goth., OHG., Ger., OIr., Lat. *in*, Gk. *ἐν*, *en*, in). The older English name of a place of public entertainment for travelers. In the early ages, when among all except the most savage peoples the law of hospitality was strictly interpreted, and when, owing to the unsettled condition of most lands, it was a necessity of existence, there was little need for public houses. The earliest approximation to what was later meant by an inn is found in the caravanserais (q.v.) of the East—unfurnished lodgings on the high roads which travelers might occupy on their passage. Such was the 'inn' which was the scene of the birth of Christ. The temples of the ancient religions usually afforded shelter for pilgrims to their shrines. This custom has been kept up in modern pilgrimage places; thus Saint Philip de Neri had an immense hospice built to receive those who came to the jubilee of 1600.

Under the Roman Emperors, houses were established at the posting-stations on the great roads, which began to approximate to the modern inn. These were not, however, open to all comers, but were at the service of Imperial messengers, and of favored persons who could show an authorization known as *diploma tractatorium*. There were also lodging-places for unofficial wayfarers, known as *diversoria* or *stabularia*, the latter affording accommodation to both man and beast. A classical description is that of Horace in his account in the *Satires* of his journey to Brundisium, where he characterizes the innkeeper in a spirit of modern protest as *perfidus caupo*. The city of Rome had many small inns, or rather lodging-houses, which had a bad name, and were daily inspected by the lictors of the prætor or ædile.

In Christian times, hospitality being named by Saint Paul as a special duty of a bishop, the episcopal cities were the first to provide shelters for strangers; and the monasteries provided shelter and food for travelers throughout the Middle Ages. Some establishments of this kind remained celebrated even at a later date, such as those on the Alpine passes of the Great and Little Saint Bernard, the Simplon, and Mont Cenis. The unusual amount of traveling brought about by the Crusades led to the establishment of brotherhoods specially devoted to the duties of hospitality, whether the recipients of it were sick or well. See HOSPITALERS.

The modern inn, at which entertainment was afforded as a matter of business, was of later growth. Erasmus gives a vivid and amusing picture of the crude provisions of the German inns in his time. Nowhere in Europe did these establishments so soon attain a recognized and respectable character as in England, where many of the old inns, with designations frequently adopted from the devices of powerful families, became famous—in London, for example, the Angel, the Bell, the Belle Savage, the Bull and Mouth, and the White Horse. The older ones were usually built round a courtyard, entered from the street by a wide covered passage. This form, possibly a survival of Roman architectural methods, was common also in France and Italy. The English inns play no small part in the literature of the eighteenth and early nineteenth centuries; and where they still exist, in the smaller places, the friendly personal attention to the guest's comfort gives them an attractiveness seldom found in the more pretentious modern hotel (q.v.). Consult: Michel and Fournier, *Histoire des hôtelleries, cabarets, hôtels garnis, etc.* (2 vols., Paris, 1851); Borchardt, *Das Gast- und Schankgewerbe in Vergangenheit und Gegenwart* (Greifswald, 1901).

INN, INNKEEPER. In point of law, an inn is a public house of entertainment for travelers for compensation. An innkeeper is a person who holds himself out as engaged in the business of receiving and affording accommodation (including food, drink, and lodging) for travelers, or other transient guests, for compensation. A tavern, being a place where only food and drink are served, was not included in the term inn; but the more modern term 'hotel' is, in a legal sense, synonymous with the term inn.

From the earliest times the common law regarded innkeepers as engaged in a public calling like that of common carriers, warehousemen, wharfingers, etc. It imposed upon them peculiar obligations and granted corresponding rights or privileges. The innkeeper is legally bound, so long as he has accommodations, to receive all proper persons applying for accommodation, and is liable for damages upon his failure to do so. In early times he was bound also to supply accommodations for his guest's horse, but it is now the law that one may engage in the business of innkeeping without supplying any accommodation for horses. The innkeeper is not bound, however, to receive one who is drunk, disorderly, affected with a contagious disease, or who is otherwise obnoxious. The prospective guest is not entitled to select whatever accommodation the inn affords, and if he will not accept such reasonable accommodation as is offered the innkeeper may order him to leave the house. As some compensation for this compulsory hospitality, the innkeeper is allowed certain privileges; thus, he has a lien on the horse and carriage or goods of the guest for that part of the bill or reckoning applicable to each respectively, and for the sum due for accommodation afforded to the guest, i.e. he may keep these until his bill is paid for their keep, even though they are not the property of the guest (see Lien), but he cannot detain the person of his guest until payment is made.

While an innkeeper has his remedy by lien for his charges, he is under great responsibility for the safety of the goods of his guests. In general, he is absolutely liable for the safety of all goods brought to his house by the guests unless the loss occurs by act of God or the public enemy. An act of God is any *vis major* in which there is no element of human agency. A public enemy is a de facto government in actual state of war with the Government to which the innkeeper is subject. (See these topics under the head of Carrier, Common.) Hence the innkeeper is liable to his guest for loss by fire or theft, although in some States the innkeeper is exempted by statute from liability for loss by fire not caused by the negligence of himself or his servants. The innkeeper is excused if the loss is caused by the guest's own negligence—as, for example, by his leaving the door of his room unlocked or by his leaving a box or package containing valuables in a public room of the inn without delivering the package to the innkeeper or his servants. An innkeeper cannot escape liability by posting a notice in the guest's room or other part of the house to the effect that he will not be answerable for such losses, such notice being contrary to the policy of the law which imposes the extraordinary liability on the innkeeper. The innkeeper may, however, make reasonable regulations for protecting the property of the guests, as requiring all valuables belonging to guests to be deposited in the innkeeper's safe, and if the guest after fair notice fails to comply with the regulation, the innkeeper is not liable for loss of the valuables, unless due to his own misconduct or that of his servants.

One who takes his meals in a public restaurant attached to an inn is not a guest of the inn itself, and his rights are merely those of a casual boarder. An innkeeper may entertain boarders living regularly in his house, as well as transient guests or travelers; but as to these his liability is only that of a boarding-house keeper. Innkeepers are subject to various statutory regulations which, owing to the fact that the innkeeper is engaged in a public calling, do not violate any of the constitutional provisions guaranteeing the rights of citizens. Thus he may be compelled to keep a regular register of his guests, provide safety appliances to avoid danger of fire, and he may even be subject to regulations as to food and accommodations. See Public Callings; Boarding-House; Bailment. Consult: *American and English Encyclopædia of Law*, vol. 16, 2d ed.; Schouler, *Bailments; James, Liens.*

INNATE IDEAS (Lat. *innatus*, inborn, from *in*, in + *nasci*, to be born). Ideas which, by some philosophers, are supposed to form part of the actual equipment or content of consciousness at birth; or if they do not appeal till later, are supposed not to be due to any experience falling within the life of the individual. The difficulty of accounting for our universal and necessary judgments (see Judgment) gave rise to this theory of innate ideas. We find the first suggestion of this theory in Plato's (q.v.) doctrine of reminiscence, and a vigorous defense, and perhaps the most elaborate statement of it, in Leibnitz's doctrine of obscure perceptions.

INNER HOUSE. The name given in Scotland to the higher division, or chamber, of the great court of the kingdom, the Court of Session (q.v.). It exercises an appellate jurisdiction over the inferior division, known as the Outer House, though its original jurisdiction is in general coördinate with that of the latter.

INNER MISSION (Ger. *Innere Mission*). The name given in Germany to a movement originated by Theodor Fliedner (q.v.) and further developed by Johann Hinrich Wichern (q.v.), who gave it its name in 1848. It is intended to elevate the whole man, and so besides specifically Church work, such as Sunday schools, rescue missions for drunkards and prostitutes, meetings for sailors, railroad employees, and strangers, it supports deaconesses to nurse the sick, maintains asylums and homes of all kinds, and takes part in the Red Cross work. Underneath all this exertion is the idea that until the spiritual nature is aroused little can be done for permanent improvement. It is distinctively a Protestant movement. There is a central committee, but it does not exercise control of the local committees. Consult: H. Behm, *Die Innere Mission, eine kirchliche Reformbewegung des 19. Jahrhunderts* (Gütersloh, 1892); *Fünfzig Jahre der Inneren Mission* (report of the Central Committee, Berlin, 1898).

INNER TEMPLE. One of the four ancient guilds of lawyers known as Inns of Court in London, having the exclusive privilege of calling persons to the English bar. See Inns of Court.

INNES, In′ĕs, Cosmo (1798-1874). A Scotch lawyer and antiquary, born at Durris. He was educated at the High School of Edinburgh, and at the universities of Aberdeen, Glasgow, and Oxford. He studied law, but never had a large practice. He arranged the documents of Register House, and edited *Rescinded Acts* and *Acts of the Scots Parliament, 1124-1707.* He displayed so great an interest in the pre-Reformation period that he was suspected of sympathy with Rome. From 1846 to 1874 he was professor of constitutional law and history at Edinburgh. His works, besides the editions mentioned, and many chartularies of Scottish religious houses, were: *Scotland in the Middle Ages* (1860); *Sketches of Early Scotch History* (1861); *Lectures on Scotch Legal Antiquities* (1872); and *Memoir of Dean Ramsay* (1874).

INNES, Thomas (1662-1744). An historian of Scotland. He was born at Drumgask, Aberdeenshire, in 1662, and educated in Paris. In 1692 he was ordained priest of the Roman Catholic Church, and passed most of his remaining years in Paris, occasionally visiting England

and Scotland, chiefly for historical research. The great object of his life was to refute the fabulous narratives of Scotland, which had been hitherto generally accepted by his countrymen, and to supply, in place of fable, a true history. The preparatory task he accomplished in his *Critical Essay on the Ancient Inhabitants of Scotland* (2 vols., London, 1729). In the preparation of this work he examined all the manuscripts and other material relating to the subject which he could find in France, England, and Scotland. The task was extremely difficult, for in his time most of these manuscripts were wholly unknown except to a few antiquaries; but the complete success of his labor is admitted by all who are acquainted with this portion of Scottish history. The *Critical Essay* has been reprinted with a memoir of the author by Grub in his *Historians of Scotland*, viii. (Edinburgh, 1879). After finishing the critical part of his task, Innes began his constructive work in his *Civil and Ecclesiastical History of Scotland.* The first volume only was completed by the author, and the second, so far as he had progressed with it, reaches merely to the year 821 (ed. by Grub for the Spaulding Club, Aberdeen, 1853). Besides these principal works he wrote many dissertations and letters, and made valuable collections of manuscripts. His death occurred in 1744. In addition to his *Memoir*, by Grub, mentioned above, consult: Chambers, *Biographical Dictionary of Eminent Scotsmen* (Glasgow, 1837); Forbes, *Ane Account of the Familie of Innes* (compiled 1698; printed for Spaulding Club, Aberdeen, 1864).

INNESS, In'ĕs, George (1825-94). An American landscape painter. He was born May 1, 1825, at Newburg, N. Y. He took his first drawing lessons when fourteen years of age, but two years later he entered a store in Newark, N. J., and soon afterwards accepted a position for one year with a firm of map-engravers. In 1843 he studied and made sketches from nature near Newark, and two years later he worked for a short time in the studio of Regis Gignoux, at New York. He opened a studio of his own in that city, and through a patron and friend was offered a trip abroad. He spent fifteen months in Italy, and in 1850 he spent one year in France. On his return he first lived in the vicinity of Boston, but in 1862 made his home in Eagleswood, near Perth Amboy, N. J. In 1868 he was elected a member of the National Academy. The latter part of his life was spent in and near New York. He died at the Bridge of Allan, Scotland, August 3, 1894. He was a man of high intellectual qualities, of keen wit, always ready to express his thoughts on art subjects with strong, clear statements.

Inness is generally considered the greatest American landscape painter. His style resembles that of the Fontainebleau-Barbison group. His subjects included the pageants of sunrise, high moon, sunset, and evening; each picture seeming to pulsate with luminous qualities, atmospheric charm, and poetical conception. He has been called a 'color poet.' His works, as to style, may be classed into two periods. The first period includes his early years of conscientious study, when great importance was given to detail, and an intimate knowledge of all the forms of nature; the subjects of these paintings were panoramic in character, although always good in composition and color-tone. After 1878 his works were rather the interpretation of some passing effect or emotion; they were full of personality, and are expressed with great breadth and simplicity in technique.

There was a notable exhibition of his paintings, numbering two hundred and forty, held at the Fine Arts Building, New York, in December, 1894; and a sale of some of the best examples, known as the Halsted Collection, in 1895, which brought large prices and much attention from the public. Many well-known amateurs possess works painted by him, and there are five in the Metropolitan Museum of Art, New York. Among the most important of his works are: "Under the Greenwood;" "Close of a Stormy Day;" "Loitering;" "Pine Groves of Barberini Villa," Metropolitan Museum; "An Autumn Morning;" "Autumn Gold" (1888); "The Edge of the Forest" (1891); "Tenafly Oaks" (1892); "Passing Storm;" "Near the Village" (1892); "Moonrise" (1886); "Winter Morning, Montclair, New Jersey" (1894).

INNESS, George, Jr. (1854—). An American landscape and animal painter, born in New York City. He was a pupil of his father, in Rome, from 1870 to 1874, and of Bonnat, in Paris. Afterwards he shared a studio with his father in New York City for several years. He began to exhibit in 1877, and became a member of the Society of American Artists in 1880, and of the National Academy of Design in 1899. He received a gold medal at the Paris Salon in 1899. His pictures include the animal subjects "Monarch of the Farm" and "Mother of the Herd" (1883); and "The Coming Storm" (1885) and "Morning on the River" (1902). His work is characterized by direct, vigorous style, and good color.

IN'NISFAIL (Ir., Island of Destiny). An ancient name applied by the bards to Ireland.

INNOCENT. The name of thirteen popes. Innocent I., Pope 402-417, a native of Albano. His pontificate was one of the most important in the early centuries, in its development of the relations of the Roman See with other churches, both Eastern and Western. He seems to have extended, if not originated, the system of naming legates to represent the Pope. He maintained with a firm hand the right of the Roman Bishop to hear appeals from other churches, and his letters abound with assertions of universal jurisdiction. At the request of Saint Augustine and the North African bishops, in 404, he induced the Emperor Honorius to pass laws for the protection of the Catholics against the Donatists. He strongly supported Saint John Chrysostom against his opponents. His last years were full of trouble, owing to the attacks of Alaric upon Rome, which in 410 was pillaged, with the exception of the Shrine of the Apostles. His last two letters were written to encourage Saint Jerome in his difficulties with the troublesome Eustochium and Paula and with the Origenists. The whole of his important correspondence is in Migne, *Patrologia Latina*, xx.

Innocent II. (Gregorio Papareschi). Pope 1130-43. He was opposed by a faction among the cardinals, who set up an antipope under the title of Anacletus II. But Innocent was supported by Louis VI., the French bishops, and Saint Bernard, and restored to Rome by Lothair, whom he crowned as Emperor. Anacletus still maintained possession of the Castle of Sant' Angelo until his death in 1138, and Innocent was obliged to absent himself from Rome during much of that time. In 1139 he held the second Lateran Council, which was attended by about a thousand bishops, and confirmed the condemnation pronounced by several councils on Abélard and the followers of Arnold of Brescia. In 1141 a conflict arose between the Pope and his former supporter, Louis VII., which resulted in an interdict covering any place where the King might be, and only removed by Celestine II. Consult: Martens, *Die Besetzung des päpstlichen Stuhles unter Heinrich III. und Heinrich IV.* (Freiburg, 1886); Mühlbacher, *Die streitige Papstwahl des Jahres 1130* (Innsbruck, 1876); and the letters of Innocent II. in Migne, *Patrologia Latina*, clxxix.

Innocent III. (Lotario de' Conti). Pope 1198-1216. This was by far the greatest Pope of the name, and under him the power of the Papacy was more widely extended than ever before. He was born at Anagni in 1161 and made cardinal by his uncle, Clement III., after a distinguished career in Paris, Bologna, and Rome. His election to the Papacy at the age of thirty-seven was looked upon with misgiving, which finds expression in a poem by the famous Walther von der Vogelweide: "O wê, der bâbest ist ze junc: hilf, hêrre, dîner kristenheit" (Alas, the Pope is too young: help, Lord, thy Christendom!). But the combined strength and wisdom of his rule soon allayed these fears. His first success was the restoration of the Papal authority in Rome and the States of the Church; but he soon extended his influence to every part of Europe. In Germany he adjudicated with authority upon the rival claims of Otho, son of Henry the Lion, and Philip of Swabia; and a second time he interposed effectually in behalf of his ward, Frederick II. In France he espoused the cause of the injured Ingeborg, whom Philip Augustus had attempted to repudiate in order to marry Agnes of Meran. Another interposition in favor of the sanctity of the marriage tie was that by which he disciplined Alfonso IX. of Leon, who had married within the prohibited degrees. His legates crowned the Prince of the Bulgarians and the King of Bohemia, and even the King of Armenia received the investiture of his kingdom from them. The history of his relations with England (see John; Langton, Stephen) is no less noteworthy as an exhibition of the extent of his supremacy. That nothing might be wanting to the completeness of his authority throughout the then known world, the Latin conquest of Constantinople put an end to the shadowy pretensions of the Eastern rivals of his power, spiritual as well as temporal. As an ecclesiastical administrator Innocent III. holds a high place. He was a vigorous guardian of public and private morality, a steady protector of the weak against oppression, and zealous in conflict with simony and other abuses of the time. He prohibited the multiplication of religious orders by private authority, but he lent all his influence to the furtherance of the remarkable spiritual movement in which the two great mendicant orders (see Franciscans; Dominicans) had their origin. The celebrated fourth Lateran Council (q.v.), held in 1215, marked the zenith of his remarkable reign. In the following year, while busily engaged in promoting peace among the Italian cities, so as to remove obstacles to the Crusade, Innocent was seized with a fever and died at Perugia in his fifty-sixth year. Consult: Von Hurter, *Geschichte des Papstes Innocenz III. und seiner Zeitgenossen* (4 vols., 3d ed. Hamburg, 1841-43); Barry, *The Papal Monarchy* (New York, 1903); Brischar, *Innocenz III. und seine Zeit* (Freiburg, 1883); Delisle, *Mémoire sur les actes d'Innocent III., suivi de l'itinéraire de ce pontife* (Paris, 1857); Lindemann, *Kritische Darstellung der Verhandlungen Innocenz III. mit den deutschen Gegenkönigen* (Magdeburg, 1885); Gasparin, *Innocent III.* (Paris, 1873); Deutsch, *Papst Innocenz III. und sein Einfluss auf die Kirche* (Breslau, 1877).

Innocent IV. (Sinibaldo de' Fieschi, Count of Lavagna). Pope 1243-54. He was born at Genoa, of a distinguished family, and was elected at Anagni by the cardinals who had fled from Rome, then occupied by the Emperor Frederick II. His first and most difficult task was to compose the strife which had long raged between this brilliant and vigorous prince and the Holy See. Terms of peace were agreed to in 1244, the Imperial commissioner being Peter de Vinea (q.v.), afterwards an antipope; but Frederick interpreted them in a sense of his own and attempted to seize the person of Innocent, who escaped to Genoa and thence to Lyons. To this city he summoned a general council in 1245 to deal with the questions at issue. (See Lyons, Councils of.) Innocent was unable to return to Italy until after Frederick's death, arriving in Rome in 1253. The conflict still continuing, he excommunicated the new Emperor, Conrad IV., on Maundy Thursday of 1254. Conrad died six weeks later: the power of the Ghibellines declined, and peace revisited Italy. Manfred, the natural son of Frederick, then took up arms again at the head of a Moorish army and inflicted a severe defeat on the Papal forces on December 2d. Five days later Innocent died at Naples. He was considered a man of great learning and did much to advance the universities of Paris and Bologna. He wrote a commentary on the Decretals of Gregory IX., which was first printed at Strassburg in 1477. Consult: Masetti, *I pontefici Onorio III., Gregorio IX. ed Innocente IV. a fronte dell' Imperatore Federico II.* (Rome, 1884); Berger, *Les registres d'Innocent IV.* (Paris, 1884); Weber, *Der Kampf zwischen Papst Innocenz IV. und Kaiser Friedrich II. bis zur Flucht des Papstes nach Lyon* (Berlin, 1900).

Innocent V. (Pietro di Tarantasia). Pope 1276. He was born in Savoy, entered the Dominican Order, and taught with great success in Paris. He was made Archbishop of Lyons in 1271 and Cardinal immediately afterwards. His Pontificate lasted only five months and was marked by endeavors to reconcile the Guelphs and Ghibellines and to reunite the Eastern churches with Rome. He left commentaries on a large part of the Bible and on the Sentences of Peter Lombard. Consult Carboni, *De Innocentio V., Romano Pontifice* (Rome, 1894).

Innocent VI. (Etienne Aubert). Pope 1352-62. He was born at Mont in the Diocese of Limoges, and elected Pope at Avignon, where he resided during his pontificate. He was a distinguished canonist, and did much to reform ecclesiastical discipline. His influence was exerted for peace in many quarters of Europe, and he encouraged learning, inviting Petrarch to reside at his Court.

Consult *Innocent VI. et Blanche de Bourbon, lettres du pape*, ed. Daumet (Paris, 1901).

Innocent VII. (Cosimo de' Megliorati, a native of Salmona in the Abruzzi). Pope 1404-06. He had distinguished himself by a knowledge of canon and civil law and by a holy life, so that he was made cardinal in 1389 by Boniface IX., whose successor he was chosen amid the troubles of the great schism. Little else than these tumults distinguished his short reign, which was marked by nepotism.

Innocent VIII. (Giovanni Battista Cibo). Pope 1484-92. He came of a noble Genoese family; his father had been a Roman senator and Governor of Naples. He was a widower when he entered the clerical state and won the favor of Paul II., who appointed him Bishop of Savona, and Sixtus IV., who made him a cardinal. He strove to promote peace among Christian princes and to unite them against the Turks, who had not long before conquered Constantinople. He quarreled, however, with King Ferdinand of Naples over the payment of the customary tribute, excommunicated him, and transferred his kingdom to Charles VIII. of France, whereupon Ferdinand yielded. His nepotism was marked; he gave his illegitimate son Franceschetto several towns near Rome, and secured for him the hand of Maddalena, daughter of Lorenzo de' Medici. In compensation he made her fourteen-year-old brother Giovanni a cardinal, and thus opened the way of the family to the Papal throne. Consult Serdonati, *Vita e fatti d'Innocenzo VIII.* (Milan, 1829).

Innocent IX. (Giovanni Antonio Facchinetti). Pope 1591. He was born at Bologna in 1519 and studied law. He was the first bishop named by Pius IV., and, after the close of the Council of Trent, was nuncio at Venice for six years. Gregory XIII. made him a cardinal, and he held important offices under this Pope and his two successors, practically administering the Papacy during the illness of Gregory XIV. His own reign, however, was cut short by death after two months, during which he had supported the League in France. He left a number of learned philosophical and political writings.

Innocent X. (Giovanni Battista Pamfili). Pope 1644-55. He was the candidate of the Spanish party in the conclave, and thus opposed by the French. He was much influenced by his sister-in-law Olimpia Maidachini, but the insinuations of Gregorio Leti are characterized by Ranke as a baseless romance. In the bull *Zelus domus Dei* of 1648 (published in 1651) he condemned the Peace of Westphalia as injurious to the rights of the Church, and in 1653 he condemned the famous five propositions of Jansen (see Jansenism). On this point consult: Hergenröther, *Katholische Kirche und christlicher Staat* (Freiburg, 1872); and for his life, Ciampi, *Innocenzo X. Pamfili e la sua corte* (Rome, 1878).

Innocent XI. (Benedetto Odescalchi). Pope 1676-89. He was born at Como in 1611, and named cardinal by Innocent X. in 1645. Appointed Bishop of Novara in 1650, he devoted the revenues of the see to the poor, and later resigned it to his brother, taking up his residence in Rome. He was a vigorous and judicious reformer, and his reign is entirely free from the stain of nepotism. In 1679 he censured as lax sixty-five propositions taken from Jesuit works on moral theology; and by the constitution *Cœlestis Pastor* of 1687 condemned still more strongly sixty-eight propositions of Molinos (q.v.). Although he owed his election to the French party, he was soon involved in conflicts with Louis XIV., which lasted throughout his pontificate. One arose over the claim of the French Ambassador in Rome to a right of asylum, which enabled him to shelter criminals, not only in his palace, but in the surrounding quarter. Precipitated by an alleged attack by the Corsican guards of the Pope, it led to a military expedition being launched against the Holy See. A more serious conflict arose when the Pope attempted to put an end to the abuse of the King's keeping sees vacant, in virtue of what was called the *Droit de régale*, and appropriating their revenues. The resistance to this attempt drew forth the celebrated declaration of the French clergy as to the 'Gallican liberties.' (See Gallican Church.) Innocent, as did Bossuet and Fénelon, disapproved of Louis XIV.'s methods of converting the Huguenots by force. On this point consult Gérin, "Le pape Innocent XI. et la révocation de l'Edit de Nantes," in *Revue des questions historiques* (Paris, 1878); also consult, id., "Innocent XI. et la révolution anglaise de 1688," ib. (Paris, 1876); id., *Louis XIV. et le Saint Siège* (2 vols., ib., 1890); Immich, *Papst Innocenz XI.* (Berlin, 1900); Michaud, *Louis XIV. et Innocent XI.*, 4 vols. (Paris, 1883).

Innocent XII. (Antonio Pignatelli). Pope 1691-1700. He was born at Naples in 1615, and, after filling important diplomatic posts, was made a cardinal by Innocent XI., whose reforming policy he set himself to imitate when raised to the Papacy after a session of the conclave lasting nearly six months. He brought about a reconciliation with France, after the French bishops had retracted the 'four articles'; and abandoned the anti-French policy which, since Urban VIII., the popes had maintained almost without exception.

Innocent XIII. (Michelangelo de' Conti, the son of Carlo II., Duke of Poli). Pope 1721-24. He was born in 1655 and raised to the episcopate and the cardinalate by Clement XI. He chose his title as Pope in memory of Innocent III., who had belonged to his family. Like his predecessor, he strongly supported the Pretender, who was always recognized as James III. in Rome. At the instance of the French Court, he very unwillingly made the Minister Dubois a cardinal; but he refused to recall the bull condemning Jansenism.

INNOCENTS, Holy, Feast of. A festival which commemorates the massacre of the children at Bethlehem (Matt. ii. 16-18). These children are referred to as martyrs by Saint Cyprian, and still more explicitly by Saint Augustine; and it is to them that the exquisite hymn of Prudentius, *Salvete Flores Martyrum*, is addressed. In the modern Church this feast is celebrated as a special holiday by the young, and many curious customs connected with it prevail in some countries. One of these is, that in private families the children are on this day privileged to wear the clothes of the elders, and in some sort to exercise authority over the household in their stead. In the Roman Catholic Church, which celebrates this festival on December 28th, the color of vestments (except when it falls on Sunday, when red, the usual color of martyrs, is employed) is violet, the color of mourning, since the innocents died before the completion of the work of redemption.

INNOCENTS, MASSACRE OF THE. (1) A painting by Tintoretto, in Venice. (2) A painting by Rubens, in Munich.

INNOCENTS ABROAD. The best-known work of Samuel Langhorne Clemens ('Mark Twain') (1869). It is the account of a trip undertaken in 1867 by a party of Americans, who chartered the *Quaker City* and visited various countries of Europe. The humor of the work consists largely in the contrast between the excitability and enthusiasm of the southern races and the assumed indifference and ignorance of the American tourists, and their refusal to be impressed by unfamiliar surroundings. The personality of various actual members of the company is amusingly portrayed, and the thoroughly American humor of the work gave it an immediate success.

INNOMINATE ARTERY (Lat. *arteria innominata,* artery without a name). The first large branch given off from the arch of the aorta at a distance, on the average, of three and one-half inches from the aortic valve. It divides into the right carotid and the right subclavian arteries. It is separated by an interval of less than one-half an inch from the left common carotid artery. Its calibre is large, and its average length is about one and one-half inches. Its course corresponds to a line drawn from the middle of the sternum, or the point of junction of the manubrium and the gladiolus, to the right sterno-clavicular joint. Its relations are as follows: In front, the inferior cervical cardiac branch of the right pneumogastric nerve, the left vena innominata and right inferior thyroid veins, the thymus gland, and the sterno-thyroid and sterno-hyoid muscles; behind, the trachea; on the right, the pleura, the right vena innominata, and right pneumogastric nerve; on the left, the left carotid artery and the thymus gland. Through the innominate artery flows all the blood to the right side of the head and neck and to the right upper extremity. Unsuccessful attempts have been made to cure aneurism of the right subclavian by tying the innominate; but they have resulted only in bringing out the fact that the collateral circulation established in such cases after the operation is ample. See the article AORTA.

INNOMINATE BONE (Lat. *os innominatum,* bone without a name). In human anatomy, the bone which forms the hip, and is provided with the socket into which the head of the femur is received. There are two of these bones in the skeleton, and each is formed by the union of the ilium, the ischium, and the pubic bone. See SKELETON.

INNOVATION. See NOVATION.

INNSBRUCK, ĭns'brōōk, in English often written INNSPRUCK. The capital and the most picturesque town of the Austrian Crownland of Tyrol, situated in the Alps, at an elevation of nearly 1900 feet, on both banks of the Inn, in a region abounding in beautiful views (Map: Austria, B 3). It lies in a broad valley, surrounded by high mountains, and has, despite its high location, a very moderate climate, the annual temperature averaging 47° F. The streets are spacious and the buildings attractive. Innsbruck comprises the old town on the right bank of the Inn and the two suburbs of Mariahilf and Sankt Nikolaus, connected with the old town by three iron bridges. In Innsbruck is found the oldest Capuchin monastery in Austria. It was begun in 1598. The Franciscan or Court church is interesting. It contains a magnificent monument to Maximilian I., consisting of a bronze statue of the Emperor on a marble sixteenth-century sarcophagus, surrounded by twenty-eight bronze statues of his ancestors and contemporaries. The sides of the sarcophagus are adorned with fine marble reliefs representing the principal events of the Emperor's life. The church possesses also a silver statue of the Virgin, and several monuments to Tyrolese patriots. The Jesuit Church, which is a seventeenth-century edifice in baroque style, not completed until 1902, surmounted by a dome of nearly 200 feet, and the parish church, with an altar-piece by Cranach, are worthy of mention.

The secular structures of Innsbruck are also interesting. The chief among them are a fifteenth-century palace, with a rich marble balcony, in late Gothic style, covered with a roof of gilded copper known as the Goldne Dachl; the Imperial palace, a rococo building of the eighteenth century, containing a spacious hall ornamented with splendid frescoes; the Ottoburg, dating from the thirteenth century; the municipal theatre; the Ferdinandeum or Tyrolese National Museum, with a façade adorned with busts of eminent Tyrolese citizens; the new orphanage; the Triumphal gate, erected in 1765, in honor of the reigning family; and the municipal buildings, possessing a collection of paintings, and graced by the Leopoldsbrunnen in front of it. Innsbruck has a monument to Walther von der Vogelweide. First among the educational institutions is the university. It was founded in 1677 by Leopold I. It has four faculties—jurisprudence, philosophy, theology, and medicine. There are 94 instructors and nearly 1000 students, 300 being theological. The library contains 100,000 volumes. The university possesses valuable Tyrolese archives. Other prominent educational institutions are the national gymnasium, founded in 1562, the municipal Oberrealschule, the commercial academy, and the military school. The Ferdinandeum contains, among its interesting collections, a picture gallery, and a library of about 40,000 volumes, including the works of all the Tyrolese authors. There are important hospitals. The chief industries are cotton and wool spinning, glass-painting and the manufacture of mosaics. There is a chamber of commerce. Innsbruck is the seat of the Governor and of the Court of Appeals for Tyrol and Vorarlberg. Among the interesting features in the environs are the historic and beautiful Isel Mountain, with Natter's bronze statue to Hofer, and the famous mediæval Ambras Castle, with a famous collection of weapons. Population, in 1890, 23,320; in 1900, 27,056, chiefly German Catholics. In ancient times the name of Innsbruck was *Œni Pons* or *Œnipontum.* The town received municipal privileges from Otho I., Duke of Meran, in 1234. From 1363, the year of the annexation of Tyrol to Austria, until 1665, Innsbruck was for the most part the residence of the Tyrolese rulers of the House of Hapsburg.

INNS OF CHANCERY. Certain houses or sets of buildings in London, which were originally places of residence and study for the law students and apprentices; hence, also, the societies which occupied the buildings. These Inns of Chancery, which were formerly called *hospitia minora*, were subordinate to the Inns of Court (q.v.), from the fifteenth or sixteenth century to the eighteenth; but they now have no public function, though several of them still exist as societies, with corporate property. The Chambers are occupied by solicitors and others. The principal Inns of Chancery are Clifford's Inn, New Inn, and Furnivall's Inn.

INNS OF COURT. The four sets of buildings in London (the Inner Temple, the Middle Temple, Lincoln's Inn, and Gray's Inn) belonging to the four legal societies which have the exclusive right of admitting persons to practice at the bar, hence the societies themselves. The origin of the inns traces back to the mediæval inns of law, the origin of which is lost in antiquity, and their present importance is but a dim shadow of their former greatness. In the later Middle Ages they became the seat of great schools of law, to which students resorted from all parts of England, and in which scholars, statesmen, and men of affairs, as well as the leaders of the bench and bar, were trained. To-day they are little more than clubs of lawyers, which maintain a few lectures for law students, and guard their admission to the bar. The distinction of the four principal inns of law (i.e. houses where law was taught), as Inns of Court, was fully established in the fifteenth century; but in earlier times, and sometimes later, the name Inns of Court, or its equivalent, seems to have included both the *hospitia majora* of the early period and the *hospitia minora*, or lesser inns, to which the Inns of Chancery (q.v.) belonged.

The four inns are each governed by a committee or board, called the benchers, who are generally king's counsel or senior counsel, self-chosen, i.e. each new bencher is chosen by the existing benchers. Each inn is self-governing, and quite distinct from the others, all, however, possessing equal privileges; but latterly they have joined in imposing certain educational tests for the admission of students. It is entirely in the discretion of an inn of court to admit any particular person as a member, for no member of the public has an absolute right to be called to the bar, there being no mode of compelling the inn to state its reasons for refusal. But, practically, no objection is ever made to the admission of any person of good character. Each inn has also the power of disbarring its members, that is, of withdrawing from them the right of practicing as counsel. This right has been rarely exercised, but of late years there have been examples of persons abusing their profession, and indulging in dishonest practices; in such cases, the inn has its own mode of inquiring into the facts affecting the character of a member, and is not bound to make the investigation public. By this high controlling power over its members, a higher character is supposed to be given to the bar as a body, than if each individual was left to his own devices, unchecked, except by the law. (See BARRISTER.) The buildings of each inn consist of a large tract of houses or chambers, which are, in general, occupied exclusively by barristers, and sometimes by attorneys, and are a source of great wealth. The buildings of the four inns are not marked by any general plan or uniformity in grouping or style of architecture, but represent the growth of succeeding centuries. The Inner Temple has a fine hall of the time of Elizabeth, with an open-timbered roof of much beauty; the Middle Temple has a library which is a nineteenth-century building with a roof studied from that of Westminster Hall. See LEGAL EDUCATION.

INNUENDO (Lat., hinting). In law, a clause in a declaration for slander or libel, in which the relation or application of the alleged slanderous or libelous words to the plaintiff is pointed out and explained. This clause is necessary only if their meaning or application is ambiguous. The term is used only in jurisdictions where common-law pleading prevails. See DECLARATION; DEFAMATION; LIBEL; SLANDER.

INNUIT, ĭn'nû-ĭt. A name sometimes applied to the American Eskimo. See ESKIMO.

I'NO (Lat., from Gk. Ἰνώ), or LEUCOTHEA. In Greek legend the daughter of Cadmus and Harmonia, and wife of Athamas, who reigned in Phthiotis, or Bœotia. He had previously wedded the goddess Nephele, who bore him Phrixus and Helle (q.v.). Ino also bore two sons, Learchus and Melicertes (q.v.), and in her jealousy plotted the destruction of her stepchildren, who were rescued by their mother. As Ino had cared for the infant Dionysus, son of her sister Semele and Zeus, Hera visited Athamas with madness, and in his frenzy he killed his son Learchus. Ino, fleeing with Melicertes in her arms, and pursued by her husband, leaped into the sea, and was received by Poseidon and the nymphs as a new goddess under the name of Leucothea. The worship of Ino-Leucothea and her son Melicertes-Palæmon was widespread. She appeared to aid the shipwrecked Odysseus, and was in general regarded as the special helper of those in extreme distress and peril at sea. The story of Ino is used with many variations by Sophocles and other Greek dramatists.

IN'OCAR'PUS (Neo-Lat., from Gk. ἴς, *is*, fibre + καρπός, *karpos*, fruit), *Inocarpus edulis.* The South Sea or Tahiti chestnut, an important tree to the inhabitants of the South Sea Islands for its fruit, a nut, which, while green, is gathered and mashed to supply a considerable part of their food. The tree is of stately growth and fine foliage; the leaves evergreen, of delicate texture, oblong, six or eight inches in length. Instead of increasing uniformly in thickness, the trees throw out buttresses to support the trunk. Small projections first appear, which later become two or three inches thick, and extend sometimes four feet from the trunk at the bottom in nearly straight lines from the root to the branches. They look like plank buttresses covered with bark. The central stem may continue for many years only six or seven inches in diameter. These natural planks are used for paddles of canoes and for other purposes. This tree has been extensively planted throughout the tropics. At Calcutta ten-year-old trees were 25 to 30 feet in height.

IN'OCER'AMUS (Neo-Lat., from ἴς, *is*, fibre + κέραμος, *keramos*, tile). A characteristic fossil lamellibranch (pelecypod) of the Jurassic and Cretaceous rocks. The valves have rounded outlines, with the surfaces broken by concentric folds, beaks low, and hinge-line without teeth. These shells are very abundant in the Jurassic and Cretaceous rocks of the Western States, some of them attaining the diameter of two feet. See JURASSIC SYSTEM.

INOCULATION (Lat. *inoculatio*, from Lat. *inoculare*, to graft, from *in*, in + *oculus*, eye; connected with OChurch Slav. *oko*, OPruss. *agins*, Lith. *akis*, Goth. *augō*, OHG. *ouge*, Ger. *Auge*, AS. *ēage*, Eng. *eye*). Intentional infection of an individual with a disease by introducing its virus into the tissues or fluids of the body. Inoculation of the lower animals is used in the study of bacteriology, for it is possible by this means to reproduce in animals, with some organisms, the pathological condition presented in the natural disease. Cultures are made of the micro-organisms of the disease, or tissues, secretions, or excretions are obtained from the diseased body, to constitute the material for use. (See DISEASE, GERM THEORY OF.) The inoculation is either *subcutaneous*, *intraserous*, *intravascular*, or *intracerebral*, according as the injection is made respectively into the tissue under the skin, into a serous cavity like the pleura, into a vein, or directly into the substance of the brain.

Criminals have been inoculated with disease for experimental purposes, as well as volunteers for science' sake. Preventive inoculation is practiced in the case of several diseases, as rabies, plague, diphtheria, etc. Virus of disease which has become weakened (attenuated) by being passed through several animals is injected into human beings who have been or are to be exposed to the disease, and the desirable blood change, together with the development of antitoxin, is obtained. (See ANTITOXIN; IMMUNITY; SERUM THERAPY.) The first use of inoculation in human beings was probably the intentional transference of smallpox. From very ancient times the Hindus, and from as early as the sixth century the Chinese, inoculated persons with smallpox and then cared for them, with the result of a smaller mortality than if they had caught the disease during an epidemic. In 1717 Lady Mary Wortley Montague, wife of the English Ambassador in Turkey, became convinced of the advantages of inoculation with smallpox, as practiced by the Greeks and Armenians there. In 1721 she caused her son to be inoculated in London. Six condemned criminals at Newgate were the next experimental cases; and, after the two children of Caroline, Princess of Wales, were also inoculated, the fashion became established among the wealthy and high-born. The mortality from smallpox in England at that time was one in five, while the mortality of the inoculated was but one in 3000. The Chinese used crusts, placed in the nostrils, or caused the children to wear the clothes of a smallpox patient. Following the Hindu method, the English made incisions in the arms, into which the pus from a pustule was introduced. In general, a milder course was taken by the disease resulting from inoculation, about fifty pocks appearing, it is said; but in some cases intense invasion followed with a fatal result. The disadvantage of the method appears from the fact that every inoculated person became a focus for the spread of the disease, and isolation was expensive. Besides, the percentage of deaths from smallpox, in spite of (or possibly because of) inoculation, increased till, at the end of the eighteenth century, one-tenth of the population of England died of the disease. After becoming very fashionable and spreading over the civilized world, inoculation fell into disrepute shortly after Jenner's introduction, in 1796, of vaccination, which he had discovered in 1775, to be a preventive of smallpox. The entire efficiency of vaccination and its safety and ease caused its rapid supplanting of inoculation. Prussia in 1835 prohibited inoculation for smallpox, and Great Britain enacted laws against it in 1840. It is said to be still in vogue in China and in Algiers. Consult: Moore, *The History of Smallpox* (London, 1815); Collinson, *Smallpox and Vaccination Historically and Medically Considered* (London, 1860). See VACCINATION; JENNER.

INOCULATION (in plants). A term rarely used in horticulture in the sense of budding (q.v.).

INOFFICIOUS TESTAMENT (ML. *inofficiosus*, contrary to duty, from Lat. *in-*, not + *officiosus*, dutiful, from *officium*, duty, from *opificium*, doing of work, from *opifex*, one who does work, from *opus*, work + *facere*, to do). In the civil law, a testament disinheriting the heir or other natural recipient of the testator's bounty. Such a will is deemed contrary to the duty which a parent owes to his offspring, and is therefore wholly or partially void. This doctrine has been adopted into the legal systems of the Continent, of Scotland, of Louisiana, and Quebec, and of other States whose law is derived from that of Rome, but does not obtain in the common-law system of England and the United States. Where it exists it is generally regulated by statute, and in general effect will be given to an inofficious testament if it embodies the reasons of the testator for the disinheritance complained of. See HEIR; SUCCESSION; TESTAMENT. Consult the authorities referred to under CIVIL LAW.

IN'OSIT (from Gk. Ἴς, *ἰς*, fibre), $C_6H_6(OH)_6+2H_2O$. A compound of carbon, hydrogen, and oxygen, extensively found in vegetables and sparingly in the muscles, lungs, kidneys, spleen, liver, and brain of man. It may be prepared by extracting unripe beans with water, boiling the extract with some acetic acid, filtering, adding normal lead acetate to the filtrate, again filtering, adding some ammonia and basic lead acetate to this second filtrate, separating the precipitate thus produced and dissolving it in aqueous sulphureted hydrogen, and finally mixing the sulphureted-hydrogen solution with alcohol and ether; the inosit is then obtained in crystalline form, viz. in the form of large rhombic tables. The composition ($C_6H_{12}O_6$) and the sweet taste of inosit led chemists to mistake it for a form of sugar; it has, however, been shown to be a derivative of benzene, C_6H_6. The presence of inosit in a substance submitted for examination may be detected by mixing a small amount of the given substance with a little nitric acid, evaporating to dryness in a platinum crucible, and treating the residue with ammonia and a little strontium acetate. The presence of inosit is thus revealed by the formation of a violet precipitate and a greenish coloration. Unlike the sugars, inosit does not undergo alcoholic fermentation, nor is it probably capable of undergoing lactic fermentation in the presence of decaying cheese.

INOUYE, ē'nô-o͞o'yä', KAORU (1839—). A Japanese statesman, born in Chōshiu. With his friend Ito (q.v.) he went to Europe, and studied two years in London. He returned in time to prevent his clansmen from fighting the allied squadrons at Shimonoseki (q.v.) in 1864. His progressive spirit and loyalty to the Emperor drew upon him the wrath of reactionary assassins, who wounded him with their swords and left him for dead on the snow. He recovered, however, and subsequently was made vice-minister of the Treasury in Tokio, in which position he was influential in having the chief thoroughfare of the city rebuilt in brick after the great fire of 1872. He was a member of the Council of State, Minister of Public Works, and for seven years Minister of Foreign Affairs. His State papers have had great weight and influence. In 1885 he was made count, and in 1892 Minister of the Interior. After the war with China he was sent to Korea to inaugurate reforms, but his splendid programme was marred during his temporary absence by the riotous invasion of the palace by Japanese ruffians, in which the Korean Queen Min was assassinated.

INOWRAZLAW, ĕ'nô-vräts'läf. A town in the Prussian Province of Posen, situated 21 miles southwest of Thorn (Map: Prussia, H 2). It has a number of foundries, machine-shops, sugar-mills, and flour-mills. In the vicinity are situated extensive Government salt-works. Population, in 1890, 16,503; in 1900, 26,141.

IN PAR'TIBUS IN'FIDE'LIUM. See Titular Bishops.

IN PERSO'NAM (Lat., against a person). In the classification of legal rights, a right *in personam* is one available against a particular person as distinguished from one maintainable against the whole world, known as a right *in rem* (q.v.). Rights *in personam* arise out of specific engagements entered into by individuals or out of duties imposed on individuals by the policy of the law. They thus comprehend all contract rights, the rights that arise out of the domestic relations or out of fiduciary or official position. Thus, the right to the performance of a contract, the right of a husband to the society of his wife, the right of a beneficiary against a trustee, in each case asserted against a determinate person, are all rights *in personam*. But by far the largest class of these rights is that which springs from the violation of other rights, whether rights *in rem* or *in personam*. A right once violated—whether a right of property by a trespass, or the right of personal security by an assault, or a contract right by a breach of contract—a right of action arises, and this right of action, being limited to the person or persons committing the act complained of is necessarily a right *in personam*. Consult the authorities referred to under Tort; Contract; and the *Commentaries* of Kent and Blackstone.

The expression *in personam* is also commonly employed to describe the action instituted for the violation of any right, whether *in rem* or *in personam*. Wherever an action is brought against an individual, whether for damages or for the restitution of money or specific property, it is properly described as an action *in personam*. The action *in rem* is in our law limited to a narrow range of cases. (See In Rem.) The phrase *in personam* is also employed in a narrower sense to describe the mode in which a legal obligation is enforced against an individual. The courts of chancery are said to act *in personam*, i.e. by ordering a person to do or to refrain from doing a certain thing, while courts of law, whose function is not to command, but to adjudicate controversies, are said to act *in rem*. See Chancellor; Chancery, Court of; Equity. Consult the authorities referred to under Procedure.

INQUEST (OF. *enqueste*, Fr. *enquête*, from ML. *inquista*, from Lat. *inquisita*, p.p. fem. sg. of *inquirere*, to inquire, from *in*, in + *quærere*, to search). A judicial proceeding for the purpose of inquiring into or investigating the facts and circumstances of a particular matter by a jury specially summoned for the purpose.

The term is applied to several special proceedings differing widely in the nature of the purposes for which they are instituted.

One of the most ancient uses of the word was as applied to a coroner's investigation. In such a case there is no element of contest, as the only object of the inquest is to gain information, and the person or persons under suspicion are not permitted to enter a formal defense. A later employment of the term was to designate an inquiry into the age of an heir who claimed his inheritance upon majority, but this practice has fallen into disuse.

At a still later date the word was applied to the proceedings before a sheriff, where he was directed by the court to summon a jury and ascertain the amount of damages suffered by a complainant, where the defendant had failed to appear or to put in a defense. (See Default.) On such an inquest the defendant might appear and cross-examine the plaintiff's witnesses, as well as bring witnesses in his own behalf to contradict the adverse testimony. This practice prevails to-day in some jurisdictions, but in New York and a few other States such an inquest is taken before the court and by any jury in attendance for the trial of causes. The plaintiff is required to introduce testimony tending to establish his cause of action as well as his damages, but no affirmative defense is permitted.

The term is further employed to describe the proceedings before a sheriff upon an attachment, replevin, or garnishment of property, when he summons a jury to determine which claimant is entitled to the property. Such a finding is not conclusive of the merits of the action, but awards the present possession of the property.

Inquest of Office. This is another application of the term which is very remote in its origin. It was first employed during the era of the Norman kings of England to describe a special proceeding held by an officer of the Crown to inquire into any matter or occurrence the legal effect of which might be to cause the forfeiture or escheat of any lands or personal property to the King. Such occurrences were very much more common at that time, when the feudal system was at its height, than at present, but such inquests may still be called under the above circumstances. Such proceedings bear the same name in most of the United States, but are very rare. The case must be tried by a jury, not of any particular number of persons; it may be twelve, or more or less than that number, as may happen to be convenient. In this country the process is resorted to when real property is to be forfeited to the State for want of heirs. In States where aliens, by the operation of the common law, are not allowed to hold real estate, an inquest of office would be applicable to vest in the State the title to lands in their possession. Consult the *Commentaries* of Kent and Blackstone; Pollock and Maitland, *History of English Law* (2d ed., London and Boston, 1899). See Action; Alien; Coroner; Inquisition; etc.

INQUILINE, ĭn′kwĭ-lĭn (from Lat. *inquilinus*, one dwelling in a place not one's own, from *incola*, inhabitant, from *incolere*, to inhabit, from *in*, in + *colere*, to cultivate). An insect which lays its eggs in a nest of some other insect, thus living parasitically at the expense of the host. The Inquilinæ form a group of gall-flies called 'guest gall-flies,' which are unable to produce galls themselves, since they do not secrete the gall-producing poison, though possessing a well-developed ovipositor. Hence, like the Nomada, etc., among bees, they are 'cuckoo-flies,' laying their eggs in galls already formed, the larvæ feeding on the inside of the gall in company with the larvæ of their host. These inquilines strikingly resemble their hosts, and are difficult to separate. There are several hundred species. The Inquilinæ, forming a section of the family Cynipidæ, are, according to Walsh, distinguished from the true gall-flies by the sheaths of the ovipositor always projecting more or less beyond the 'dorsal valve,' which is a small hairy tubercle at the top of the seventh abdominal segment. This dorsal valve also projects greatly. In almost all the species the ovipositor projects from between the tips of the sheaths. Among the inquiline genera are Synophrus, Amblynopus, Synerges, and Aulax, which are 'guests' of various species of Cynipides. The cuckoo-flies (Chrysididæ) are all inquilines, laying their eggs in the nests of wasps and solitary bees; some are true parasites.

One of the eight species of British wasps is said by Sharp to be a guest wasp. Guest bees are not rare; they do not work, the organs for collecting and carrying pollen having been lost by disuse. Guest bees enter the nests of both solitary and social bees and lay their eggs, the young feeding upon the pollen stored up for the young of their hosts, but not directly destroying their young hosts. Nomada (q.v.) is a gaily-colored bee which boards with species of Halictus, Andrena, etc. Packard states that there seemed enough food in the nest for the young of both host and boarder, as they were found to live harmoniously together, and their hosts and their parasites are disclosed both at the same time. The species of Cœlioxys live on the leaf-cutting bee (Megachile), those of Psithyrus on the bumblebee. In this guest bee the mandibles of the female are acute and two-toothed, their legs (tibiæ) are convex, so that they cannot carry pollen, while they have no pollinigerous organs. The habits of these guest bees afford interesting examples of the effect of change of habits on their structure. For the guests of ants and termites see Insect, paragraph *Social Insects.*

Bibliography. Packard, *Guide to Study of Insects* (9th ed., New York, 1889); Sharp, *Cambridge Natural History*, vols. v.-vi. (London, 1895-99).

INQUIRY, WRIT OF. A common-law writ or process directed to a sheriff commanding him to empanel a jury for the purpose of assessing damages. It is employed against a defaulting defendant. The proceedings under such a writ are termed an inquest. See Inquest.

INQUISITION (Lat. *inquisitio*, inquiry, from *inquirere*, to investigate, from *in*, in + *quærere*, to seek), The (*Inquisitio hæreticæ pravitatis*), called also the Holy Office. A tribunal in the Roman Catholic Church for the discovery, repression, and punishment of heresy, unbelief, and other offenses against religion. From the very earliest times Christians looked with horror upon all heresy. As soon as the Council of Nicæa (325) had formulated its creed, Constantine attempted to repress all dissent, but it was not until 385 that any one was executed for heresy. From this time, in the East, persistence in heresy was legally punishable with death. In the West, however, among the tolerant Germans there was no tendency for several centuries to inflict the capital sentence for heresy. In the twelfth century there were some executions, but the Church in general preferred milder measures. Peter II. of Aragon, in 1197, was the first Western ruler to decree that heretics should be burned at the stake. This became the common rule in Italy, Germany, France, and Spain in the following century. The ecclesiastical cognizance of heresy, and its punishment by spiritual censures, belonged to the bishop or episcopal synod; but the bishops seldom fulfilled this duty, because they were too fully occupied. No special machinery for the purpose was devised, however, until the spread, in the twelfth and thirteenth centuries, of certain sects reputed dangerous alike to the State and to the Church—the Cathari, Waldenses, and Albigenses—excited the alarm of the civil as well as of the ecclesiastical authorities. At that time heresy was regarded as a crime against the State no less than against the Church. An extraordinary commission was sent by Pope Innocent III. into the south of France to aid the local authorities in checking the spread of the Albigensian heresy, and a council held at Avignon in 1209 directed that in each parish the priest and two or three laymen in good repute should be appointed to examine and report to the bishop, all such offenses discovered within the district. The fourth Lateran Council (1215) earnestly impressed, both on bishops and magistrates, the necessity of increased vigilance against heresy.

So far, however, there was no permanent court distinct from those of the bishops; but by successive edicts, from 1227 on, a special tribunal for the purpose was instituted, the direction of which was confided chiefly to members of the Dominican Order (1232). The Inquisition thus constituted became a general, instead of, as previously, a local tribunal; and it was introduced into Italy, Spain, and the southern provinces of France.

The procedure of the Inquisition deserves a brief notice. A person suspected of heresy, or denounced as guilty, was liable to be arrested and detained in prison, to be brought to trial only when it might seem fitting to his judges. The proceedings were conducted secretly. He was not confronted with his accusers, nor were their names even then revealed to him, but the suspect could make known his enemies, whose evidence would thereupon be excluded. The evidence of an accomplice was admissible, and the accused himself was liable to be put to the torture in order to extort a confession of his guilt. Any such confession, however, had to be repeated afterwards without torture in order to be accepted. But if the accused refused to repeat his confession he might be tortured again. As a punishment the condemned were sentenced to make pilgrimages, to wear signs of infamy such as the yellow cross, or to imprisonment, and in extreme cases were condemned to death. This extreme penalty, however, could be inflicted only by the State, and out of 636 persons condemned between 1308 and 1322 only 40 were turned over to the State. The State was required to enforce the laws of the Church as a part of the ruler's duty as a Christian. If the ruler refused he might be excommunicated or in extreme instances deposed. The Papal Inquisition had no standing in England and the northern countries, where all such matters were attended to either by the Bishops' Inquisition, or, as in England, by the royal power. In Languedoc the Inquisition was very active for about a century, but by the end of the first quarter of the fourteenth century it had practically spent its force. In Northern France the history of the Inquisition is more obscure, but by the end of the fourteenth century it is certain that it was decadent. Philip the Fair, however, made use of the Inquisition against the Templars and in 1312 made it a State tribunal. In most of the Italian cities except Venice it was very powerful. In Germany it had a very slight influence.

It is in Spain, Portugal, and their dependencies that the Inquisition attained its fullest development. As an ordinary tribunal similar to those of other countries it had existed in Spain from an early period. Its functions, however, in these times were little more than nominal; but early in the reign of Ferdinand and Isabella, in consequence, it is said, of the alarms created by the alleged discovery of a plot among the Jews and the Jewish converts—who had been required either to emigrate or to conform to Christianity—to overthrow the Government, an application was made to Pope Sixtus IV. to permit its reorganization (1478); but in reviving the tribunal the Crown assumed to itself the right of appointing the inquisitors, and, in fact, of controlling the entire action of the tribunal. The establishment of the tribunal of the Inquisition was sanctioned by the Cortes at Toledo in 1480, and from this date the Spanish Inquisition became a State tribunal, a character which is recognized by Ranke, Guizot, Leo, and even the great anti-Papal authority Llorente. In order to prove that the Church generally, and the Roman See itself, was dissociated from that State tribunal, the bulls of Pope Sixtus IV., which protest against it, are cited. Notwithstanding this protest, however, the Spanish Crown maintained its control of the Inquisition. The work of the Inquisition began in 1481, when Miguel Morello and Juan Martin, members of the Dominican Order, were appointed inquisitors for Seville. In 1483 the Inquisition was extended over Aragon and Leon, and the Dominican Tomas de Torquemada (q.v.) became the first Grand Inquisitor. The popes attempted to control the arbitrary action of the royal tribunal and to mitigate the rigor and injustice of its proceedings, but these measures were ineffective to control the fanatical activity of the local judges. When, however, Spain sought to introduce its peculiar Inquisition into Naples also, Pope Paul III., in 1546, exhorted the Neapolitans to resist its introduction. However severe the weight of the Inquisition may have been on heretics and unbelievers, the number of its victims as given by Llorente, an historian of the Inquisition, is enormously exaggerated. His statements deserve no credence whatever, although he had excellent opportunities of learning the truth, as he was the secretary of the Inquisition for a time. He was a violent partisan, and his errors and exaggerations have been exposed, especially by Hefele in his *Life of Cardinal Ximenes* (Eng. trans., 2d ed., London, 1885); Ranke does not hesitate, in his *Fürsten und Völker des südlichen Europas* (4th ed., Leipzig), to impeach his honesty. While he gives the number of executions as 341,042, the Catholic authority Gams states 4000 to have been the total. Protestant writers have usually given figures varying between the lowest and the highest. Charles V. (1516-56) and Philip II. (1556-98) made attempts to transfer the Inquisition also to the Netherlands, but there is no question that here it was political, intended to suppress a revolt rather than a heresy.

The Spanish Inquisition is condemned by Protestants and non-Spanish Catholics alike. Spanish Catholics, however, are inclined to defend it, and hold that its form of proceeding was not as usually stated, but was fair and equitable, considering what a fearful crime heresy was and is in the eyes of the Catholic Church. There is no doubt, moreover, that many of the crimes tried by the inquisitors in Spain were such as would now be brought into our ordinary civil courts.

The rigor of the Spanish Inquisition abated in the latter part of the seventeenth century. In the reign of Charles III. it was forbidden to punish capitally without the royal warrant; and in 1770 the royal authority was required as a condition even for an arrest. In 1808, under King Joseph Bonaparte, the Inquisition was suppressed. It was revived under the Restoration, was again suppressed on the establishment of the Constitution in 1820, but was partially restored in 1825, nor was it till 1834 that it was finally abolished in Spain, its property being applied two years later to the liquidation of the national debt.

From Spain the Inquisition was transplanted into all the Spanish-American countries, and it continued to exist in these countries until they became independent. From Portugal the Inquisition was extended to the Portuguese colonies in India. The rigor of its process, however, was much mitigated in the eighteenth century, and under John VI. it fell entirely into disuse.

The Inquisition in Rome and the Papal States never ceased, from the time of its establishment, to exercise a severe and watchful control over heresy, or the suspicion of heresy, which offense was punished by imprisonment and civil disabilities; but of capital sentences for heresy the history of the Roman Inquisition presents few instances, and according to Balmes, *On Civilization* (6th ed., Madrid, 1875), that tribunal "has never been known to order the execution of a capital sentence" for the crime of heresy. The tribunal still exists under the direction of a congregation (*congregatio sancti officii*), originally founded by Paul III. in 1542, and reorganized by Sixtus V., but as by its very constitution it must call upon the State aid to enforce its decrees, and as such State aid can nowhere be obtained at the present day, its action is limited to the imposition of spiritual punishments, such as excommunication.

Consult: Lea, *History of the Inquisition of the Middle Ages* (3 vols., New York, 1887-88), a standard work; French translation, containing the author's latest revisions, by Reinach (Paris, 1900, ff.), with an excellent bibliographical introduction by Frédéricq; Molinier, *L'inquisition dans le midi de la France* (Paris, 1880); Tanon, *Histoire des tribunaux de l'inquisition en France* (Paris, 1893); Frédéricq, *Geschiedenis der inquisitie in de Nederlanden* (2 vols., Ghent, 1892-96); Gams, *Kirchengeschichte Spaniens*, vol. iii. (Regensburg, 1862-79); Lea, *Chapters from the Religious History of Spain* (Philadelphia, 1890); Hefele, *Cardinal Ximenes* (Eng. trans., 2d ed., London, 1885); Rodrigo, *Historia verdadera de la Inquisición* (3 vols., Madrid, 1876); Orti y Lara, *La Inquisición* (Madrid, 1877). The literature is voluminous, but these books represent all points of view now held by scholars, and will furnish more complete bibliographies.

INQUISITION. The formal instrument in writing setting forth the verdict or decision of a sheriff's or coroner's jury as a result of their inquiry into the facts of the matter referred to them. It is certified and signed by each of the jurors, and is usually required to be filed in some public office as a record of the inquest. It does not operate as a judgment, but is sometimes the basis of further proceedings in the matter. For example, if a coroner's jury summoned to inquire into the cause of the death of A find that he was killed by B under circumstances not justifiable by law, the proper authorities will cause the latter to be indicted. The inquisition is not evidence against him, being merely for the information of the public prosecutor.

The word is less frequently used to describe the proceedings at an inquest, but this leads to confusion, and is not sanctioned by the best authorities. See Inquest.

IN REM (Lat., in, or with respect to, a thing). In the classification of legal rights, a right *in rem* is a right of a general character, available against the whole world, as distinguished from a right *in personam*, which is a right against a determinate person (*in personam certam*). Rights *in rem* are not limited to things, i.e. to property, as the phrase might indicate, but comprehend all rights, whether in respect to person or property, which are claimed or asserted against all persons whatsoever, and not against any particular individual. Thus the right not to be assaulted, the right to personal liberty and security, are rights *in rem*, as well as the right to be free from trespass or other invasion of a property right. See In Personam.

The expression is also employed to designate a form of action in which the remedy sought is not damages against an individual, but the seizure and detention of specific articles. In such cases the thing sought to be recovered or charged with the claim of the plaintiff is personified for the purpose of making it the defendant in the action. Such proceedings are not common in our legal system, the ordinary process for the recovery of land or goods being really an action *in personam* against the person wrongfully withholding the property. But in admiralty practice such actions are common. They are brought for the enforcement of maritime liens against a vessel or cargo, for the recovery of salvage, to procure the forfeiture of property for a violation of the revenue laws, or to obtain possession of a prize in time of war. See Maritime Law.

I. N. R. I. The first letters of the Latin inscription placed on the cross by Pilate at the crucifixion of Christ: *Iesus Nazarenus Rex Iudæorum*, 'Jesus of Nazareth, the King of the Jews' (John xix. 19).

INSANE ASYLUM. An institution for the care and treatment of the insane. Monasteries appear to have been the representative of such retreats in the mediæval Christian times; but restraint and rigid asceticism characterized their management. Out of conventual establishments grew the bethlems, or bedlams, with which the English of two generations ago were familiar. (See Bedlam.) The vast majority of the insane must have been neglected; in some countries, reverenced as specially God-stricken; in others, tolerated, or tormented, or laughed at, as simpletons or buffoons; in others, imprisoned as social pests, even executed as criminals. In a few spots, enjoying a reputation for sanctity, or where miraculous cures of nervous diseases were supposed to have been effected, such as Gheel and Saint-Suaire, communities were formed, of which lunatics, sent with a view to restoration, formed a large part, and resided in the houses of the peasants, and partook of their labor and enjoyments. Asylums, properly so called, date from the commencement of the nineteenth century; and for many years after their institution, although based upon sound and benevolent views, they resembled jails both in construction and the mode in which they were conducted, rather than hospitals. Until about 1880 a model erection of this kind was conceived necessarily to consist of one vast building, the centre of which was appropriated to the residence of the officers, the kitchen and its dependencies, the chapel, etc., from which there radiated long galleries, in which small rooms, or cells, were arranged upon one or both sides of a corridor or balcony, having at one extremity public rooms, in which the agitated or non-industrial inmates, as the case might be, spent the day, while the more tractable individuals were withdrawn to engage in some pursuit, either in workshops, clustered round the central house, or in the grounds attached, which were surrounded by high walls. The population of such establishments, when they were appropriated to paupers, ranged from 100 to 1400 patients. These were committed to a staff composed of a medical officer, matron, and attendants, to whom were directly intrusted the management, discipline, and occupation of the insane, in accordance with regulations or prescriptions issued by the physician. A gradual but great revolution has taken place in the views of psychologists as to the provisions and requirements for the insane during seclusion, chiefly through Conolly's influence, in 1847 and subsequently. As a result of this change, asylums, especially for the wealthy classes, are similar in their arrangements to ordinary dwelling-houses; while it is proposed to place the indigent in cottages in the immediate vicinity of an infirmary, where acute cases, individuals dangerous to themselves or others, or in any way untrustworthy, could be confined and actively treated, as their condition might require. In all such establishments, whether now entitled to be regarded as cottage asylums or not, the semblance and much of the reality of coercion has been abolished; the influence of religion, occupation, education, recreation, the judicious application of moral impressions, and the dominion of rational kindness and discriminating discipline, have been added to mere medical treatment, and substituted for brute force, terror, and cruelty. In fact, the word 'asylum' has been supplanted by 'hospital;' 'keepers' have given place to 'nurses' and 'attendants;' and the insane are treated, especially in institutions in the United States, as sick people. (See Insanity.) Consult: Esquirol, *Des maladies mentales*, etc. (Paris, 1838; English trans. by Hunt, Philadelphia, 1845); Guislain, *Traité sur l'aliénation mentale et sur les hospices des aliénés* (Amsterdam, 1826); Conolly, *Construction and Government of Lunatic Asylums* (London, 1847); v. Krafft-Ebing, Kirn, Neumann, Fr. Fischer, Eickholt, Wilser, Landerer and Diez, *Festschrift zur Feier des fünfzigjährigen Jubiläums der Anstalt Illenau* (Heidelberg, 1892); Allison, "The Care and Custody of the Convict and Criminal Insane," in *Proceedings of the National Prison Association* (Washington, 1901). See Insanity.

INSANITY (Lat. *insanitas*, from *insanus*, insane, unsound, from *in-*, not + *sanus*, sane, sound; connected with Gk. σάος, *saos*, σῶς, *sōs*, sound, safe), or Lunacy. A manifestation of disease of the brain characterized by a general or partial derangement of one or more of the mental processes, in which, while consciousness is not abolished, mental activity is weakened or perverted. This definition is modified from that given by Hammond, and, like all attempted definitions of the term, is inadequate. Insanity is not mental disorder, although disorder of mind is always present in insanity. A person who mistakes red for gray has disordered mentality; but he is not insane, though color-blind. Defective reasoning, which leads a man, for instance, into a bad investment, is a disordered mental process, yet not insanity. Thus it is a matter of extreme difficulty to define insanity so as not to include the conditions existing in sleep, or trance, or the common manifestations of general neuroses like epilepsy, hysteria, and chorea, the delirium of fever, acute intoxications, etc. There is no rigid line of demarcation between sanity and insanity. The conditions of each bear close resemblance. The processes of mental action in sanity and in insanity are of the same kind, although they differ in their origin and in the degree of their intensity. It is often said that every one is more or less insane. This is an absurdity, as insanity is a manifestation of disease, not merely a name for mental disorder. The notion, also, that one may be insane on one subject, and otherwise perfectly sane, is erroneous, for the same reason. An insane person may betray his mental condition when drawn out by one line of thought, or when one topic is broached; but, if insane, he is diseased and in no respect sane, even if able to carry on his business or perform complex acts properly.

To understand insanity one must understand the normal action of the mind and have some knowledge of the physical basis of mental action: that is, of the cerebral cortex and its association fibres. (See Nervous System.) The functions of the cerebral cortex are: (1) To receive impressions from the organs of sensation (conscious perceptions); (2) to group these impressions into a unit, known as a concept; (3) to store up these concepts, for future recognition and recollection (memory), for gathering into novel combinations (imagination), and for use as a basis of thought; (4) to express thought in speech and action; (5) to experience emotion which accompanies mental activity; (6) to exert self-control over all mental action. (Starr.) This statement is true enough for the practical study of insanity, and is made to avoid opening the subject of the connection between nervous and mental phenomena. While many alienists accept the anatomical basis, and believe in a transference of the mental into the material, others claim that the activity of the highest nervous centres is attended by a mental state, but is not in itself a mental state. (See Mind.) At all events, when areas of the cortex are diseased, one or more of the cortical functions named may be suspended, and mental disorder results. If changes in blood-supply or in nutrition occur, or if disease affects the entire cortex, insanity may result; and, as a result, thought becomes illogical, emotion becomes excessive, or arises without external stimulus, action is irregular or purposeless, and conduct is not properly adjusted to surrounding circumstances. In the insane person impressions from sense perceptions may be wrongly interpreted. An illusion is a falsely interpreted sense perception. For example, a chair may be mistaken for an animal; the rumble of a wagon may be mistaken for the angry voices of a pursuing mob. Ideas may arise without any sense perception. When quiet exists, the insane person may hear voices; he may see faces in an empty space; he may smell burning flesh when no odor is present. These false perceptions without external origin in sensory experiences are called hallucinations. A mistaken idea may be harbored by any one; for example, one may believe that a stone is much larger than it is. Measurement and examination convince him of his error, and, if he is sane, he corrects his judgment. The insane man is not affected by logical methods, and retains his erroneous idea in spite of demonstration and reasoning. A mistaken idea accepted without logical foundation is a delusion; if retained in spite of demonstration of its falsity, it is an insane delusion. Insane people frequently, though not necessarily, exhibit delusions, varying according to the bodily ills, the occupation or profession, the emotions experienced, or their surroundings. Certain forms of delusion are fairly constant in certain types of insanity. For example, in melancholia patients often declare that they have committed some great sin; in paranoia, delusions of persecution and of conspiracy are present; in mania, delusions of identity, or of being an important person, are frequent; in alcoholic insanity, the delusion of marital infidelity is common; in general paresis, a number of grandiose delusions—of power, of wealth, of strength, of beauty—are present in one stage; and in early stages of dementia delusions of grandeur are also noticed, with less frequency. *Disturbances of emotional feeling* occur in insane people: depression, exaltation, languor, and absurd joy are noticed in different cases. Acting under the impulse of delusion or hallucination the insane exhibit *disturbance in voluntary action and conduct.* Insufficient motive causes action, because of impaired intellectual power, or impaired memory, or sub-consciousness. *Consciousness is impaired;* external objects are often ignored; changes of personality occur.

Besides these mental signs of insanity, there are many somatic, or physical, symptoms. These are generally divided into five classes: (1) Sensory symptoms, such as pain, hyperæsthesia (q.v.), or anæsthesia (q.v.). (2) Changes in reflex action, from disease or other cause, such as lessened knee-jerk (q.v.) or dilated pupils. (3) Motor disturbances, such as loss of muscular control, shown in altered handwriting, altered speech, gait, attitude, etc.; convulsions or paralysis may also occur. (4) Changes in circulation and nutrition, such as pallor or flushing, loss of flesh, impaired digestion. (5) Disturbances of sleep, which occur commonly.

The study of disease affecting the mind is called alienism, or psychiatry, less often (in Great Britain) medico-psychology. The specialists who give their attention to insanity and the treatment of the insane are called alienists.

An accurate classification of diseases affecting the mind is difficult. Various alienists have produced different tables, but the most satisfactory is the classification of Krafft-Ebing (q.v.), or some modification of it, such as the following table, as adopted in his lectures by M. Allen Starr (q.v.), of New York:

CLASSIFICATION OF MENTAL DISEASE.

A. Mental diseases without apparent organic lesions.
  I. *Psychoneuroses, in healthy brain.*
    1. Melancholia.
      a, simple.
      b, with delusions.
      c, with agitation.
      d, with stupor.
    2. Mania.
      a, simple.
      b, with frenzy.
    3. Confusional insanity.
    4. Stuporous insanity.
      a, simple. Primary dementia.
      b, with periods of ecstasy. Katatonia.
    5. Terminal dementia.
  II. *Psychical degeneration in weak brain.*
    1. Periodical psychoneuroses.
    2. Partial degenerative insanity.
      a, emotional. Hysterical.
      b, moral.
      c, impulsive.
    3. Paranoia.
B. Mental diseases with organic lesions.
    1. Alcoholic insanity.
    2. Senile dementia.
    3. Syphilitic dementia.
    4. Paretic dementia.
C. Mental defects with maldeveloped brain.
    1. Imbecility.
    2. Idiocy.

An additional group might be added, including the *complicating insanities*, embracing traumatic, choreic, post-febrile, rheumatic, gouty, phthisical, sympathetic, and pellagrous insanity, as suggested by Spitzka.

Melancholia is characterized by a depressed emotional state. (See MELANCHOLIA.) Mania is characterized by an exalted emotional state. (See MANIA.) Confusional insanity is characterized by incoherence and confusion of ideas without essential emotional disturbance. It is a rare condition, dependent upon cerebral exhaustion, and follows emotional shock, cerebral overstrain, or exhausting disease. Some class it as a form of dementia. Stuporous insanity resembles confusional insanity. In it there is an impairment or suspension of the mental energies, without emotional disturbance; an indifference and indolence; an apathy. It is an acute primary deterioration following exhausting disease, excesses, shock, or hemorrhage, from which recovery is generally rapid. Katatonia is characterized by periods of ecstasy, during which the patient may be very voluble, alternating with cataleptic or apathetic intervals. (Spitzka.)

Dementia is a weakened intellectual state in which thought, reason, and volition are impaired or suspended; considerable indifference or total apathy existing. The patient is 'childish,' lives a vegetative existence, gradually losing intellectual ground, and drifting into mental decay. When this condition follows mania, melancholia, or other mental disease, it is called terminal dementia. Some terminal laments have periods of excitement, and are noisy and restless; but most are quiet, tractable, and childish. Periodical insanity is the term given to the mental state in neurotic patients who have recurring attacks of mental disease at fairly regular intervals. Some will have an annual attack of mania for many years. Others will have a brief attack of melancholia with each menstrual period. Some have an attack of melancholia of a few days' duration, followed by an explosion of maniacal violence, lasting a week, and this in turn followed by a period of stupor or confusion. From the last the patient emerges in a few weeks, and a lucid interval of a few months follows. This is called circular insanity. Partial degenerative insanity occurs in people who have little self-control, defective reasoning power, and impatience of restraint. It includes emotional insanity (*folie raisonnante*), in which baseless irritability, jealousy, outbursts of rage and fury occur; moral insanity, in which there seems to be an absolute want of appreciation of right and wrong, and the patient ignores all laws of custom, conventionality, decency, and morality; and impulsive insanity, in which the patients act on sudden impulses, without reasoning, obeying imperative ideas, right or wrong, in spite of their wish to control themselves and do otherwise. (See DIPSOMANIA; KLEPTOMANIA; PYROMANIA.) Paranoia is a chronic delusional insanity in which intellection is unimpaired. (See PARANOIA.) Alcoholic insanity is characterized by erotic ideas, hallucinations of sight, hearing, and smell, delusions of marital infidelity, and great restlessness. In the chronic form the patient suffers from violent attacks of temper and fairly constant irritability, and the hallucinations constitute a daily torture. These hallucinations are always fearful; the patient fancying that he sees horrible animals, devils, enemies, or pitfalls, and that he hears threats, curses, obscene language, and noisy shouts, and that he smells foul odors, or dangerous electricity, or poisonous gases. (See ALCOHOLISM.) In senile dementia the patient manifests a loss of affection for his relatives, delusions of grandeur or great egotism, suspicion without cause, impairment of memory and of judgment, and delusions regarding his possessions and money, generally fearing poverty or theft. Syphilitic dementia occurs in victims of syphilis. They evince excitement or depression, loss of memory, and failure of other intellectual processes, finally relapsing into a condition resembling terminal dementia of the quiet type, of short duration, during which partial and temporary paralyses often precede death. Paretic dementia is also called general paresis, progressive general paralysis of the brain, and, improperly, 'softening of the brain.' See PARESIS. See also IMBECILITY and IDIOCY.

Of the complicating insanities, the traumatic variety is a variety of mania following severe injury, such as gunshot wound, and is characterized by great restlessness, delirium, and jactitation. Choreic insanity rarely occurs in protracted cases of chorea, maniacal outbreaks, confused delirium, emotional change, and impairment of memory resulting. Dementia may follow. The post-febrile insanities are psychoses complicating diseases, accompanied by high fever, such as scarlet fever, smallpox, pneumonia, typhus and typhoid fevers. As a rule, the patients are lucid during the day, but suffer from delirium, illusions and hallucinations, delusions of identity, and generally anxiety, during the night. Even though maniacal and melancholic states alternate, and confusion of ideas is constant throughout, the prognosis for recovery is generally favorable. Rheumatic, gouty and toxic insanities are similar. Phthisical insanity, which is intercurrent in some cases of fatal tuberculosis, resembles the post-febrile variety, but there is also a considerable egotism and some delusions of grandeur.

It will be seen that perversion of the will is present in almost every case of insanity. This fact led Hammond to incorporate in his definition of the term the statement that in insanity 'mental freedom is weakened, perverted, or destroyed.' Free determination of the will is presented by delusions, by inferences from delusions, by abnormal emotional states, by delirium, by incoherence of ideas, or by dementia. Often the mental processes of the insane are identical with those of the sane, but the premise from which the argument springs is false. In many forms of insanity the *ego* is preëminent. A lunatic may consider himself powerfully equipped, mentally and physically. He is expansive, elated, extravagant, arrogant, and garrulous. This condition is termed *hyperbulia*. Another may be depressed, dejected, apathetic, mentally slow and impeded, hopeless, and even suicidal. This condition is termed *abulia*. Fanciful subdivisions have been made by some alienists, founded upon certain trains of thought or often recurring ideas, and terms have been devised to indicate the trend of imagination in patients experiencing these ideas. For example, *agoraphobia* denotes fear of being in an open place or street; *claustrophobia*, fear of being shut in a room or house; *mysophobia*, fear of defilement, pollution, or contamination; *pyrophobia*, fear of fire; *astraphobia*, fear of lightning; *anthropophobia*, fear of society. This list might be prolonged indefinitely.

CAUSES. The causes of insanity are divided into two classes: (1) Predisposing causes, including stress and strain, neuropathic constitution, and heredity (of alcoholism, epilepsy, insanity, or other nervous disease). (2) Exciting causes, including shock, intense emotion, worry, and intellectual overwork, exhausting diseases, excesses (alcoholic or sexual), the strain of childbirth, sunstroke, etc. In the report of the New York State Commission in Lunacy for the year ending September 30, 1900, the following were the causes assigned for insanity in 4819 cases admitted to the New York State Hospitals for the Insane in the preceding twelve months: *Moral causes:* Adverse conditions, loss of friends, business troubles, etc., 354; mental strain, overwork, worry, 384; religious excitement, 65; love affairs, including seduction, 32; fright and nervous shock, 95. *Physical causes:* Alcoholism, 476; sexual excess, 24; venereal diseases, 94; masturbation, 90; sunstroke, 50; accident or injury, 87; pregnancy, 9; parturition and puerperium, 136; lactation, 15; change of life, 100; fevers, 23; privation and overwork, 80; epilepsy, 183; other convulsive disorders, 5; diseases of skull and brain, 76; old age, 239; exophthalmic goitre, 1; epidemic influenza, 40; abuse of drugs, 44; loss of special sense, 6; uræmic poisoning, 2; other auto-infection, 1; all other bodily disorders and ill health, 294; heredity, 357; congenital defect, 44; unascertained, 1413. It may be added that 43 persons found not to be insane were committed during the year. Of the 4819 new cases admitted, 1069 had inherited predisposition.

NATIVE AND ALIEN INSANE. The matter of the alien insane has attracted the attention of a statistician who finds that there are confined and supported in this country a number of alien insane far in excess of the proportion which the foreign-born population bears to the native-born. The proportion of native-born to foreign-born in 1900 was 86 to 14. In 1901 the proportion of native-born insane to foreign-born insane was 65 to 35. This excess of foreign-born insane imposes an immense expense upon the taxpayers, for it is estimated that their maintenance costs not less than $10,000,000 a year. The foreign-born insane cost New York State about $1,000,000 annually. The danger to the population from absorbing a deteriorated and degenerate foreign stock is apparent. The present law (1903) provides that an immigrant may be returned to his native country if he becomes insane within one year. Economists are calling attention to the necessity of making the time of probation at least two years, and of conducting a searching examination into the history and antecedents of all immigrants.

PROGNOSIS. About 60 per cent. of the cases of melancholia and mania recover. Terminal dements, paranoiacs, senile dements, syphilitic dements, and paretics never recover. Cases of partial degenerative insanity rarely recover. The average number of recoveries of all kinds of cases, excepting the hopeless, is over 40 per cent. Most recoverable cases emerge during the first year of their illness; few recover after two years have passed. Early confusion of ideas, indecency, persistence of delusions, and obesity are unfavorable symptoms. Recurrence occurs in about 25 per cent. of ordinary asylum patients. The offspring of insane parents are defective; therefore no one who has ever been insane should propagate children.

TREATMENT. The treatment of insanity is a matter of great complexity. There can be no magical removal of manifestations by specific drugs. All improvement is slow. Dietetics forms an important part of the regimen; as do regular exercise; judicious control or direction; diversion by means of games, music, or the play; occupation, which is of great importance; isolation from worry, care, noise, company, or habitual environment; and the contact with the healthy, hopeful, reasoning minds of nurses and physicians. Drugs are indispensable in many conditions of malnutrition, insomnia, disordered circulation, etc. Restraint by means of mechanical contrivances is almost abolished in well-ordered asylums, except the restraint of confinement and of regulations. But some form of mechanical restraint is necessary and very helpful in certain cases, such as absolute refusal to take food, or determined attempts at suicide. Most cases require sanitarium or asylum treatment.

MEDICO-LEGAL ASPECTS OF INSANITY. The plea of insanity as an excuse for crime has been fashionable at intervals. There are cases of imperative impulse in partial degenerative insanity under which the lunatic commits an act which would be a crime in a sane man, but for which the lunatic is irresponsible. No case occurs in which but one insane act is committed, while the person was well balanced before that act and remains well balanced forever after it. In authentic cases, a well-marked history of insanity before the act can be elicited, and insanity continues thereafter. 'Temporary aberration' in an otherwise sane person does not occur. Amnesic and irresponsible intervals occur in psychic epilepsy (see EPILEPSY), during which crime may be committed; but the preceding and continuing epilepsy will be established. The knowledge of right and wrong is an improper basis upon which to judge the mental condition of a criminal. With a keen sense of right and wrong, a desire to do the right, and a dread of punishment, an insane person may obey and commit a crime under the all-powerful compulsion of an imperative impulse, in utter helplessness. But when insanity is established as the cause of a crime, the unfortunate perpetrator should be committed to an asylum in place of a jail. Lunatics should be, in general, confined in hospitals or retreats. Their prospect of improvement or recovery is never injured by incarceration in a proper institution. Society deserves protection from their acts, fraught with danger to themselves or others. The physical and financial interests of their families deserve consideration. Their individual interests are advanced by confinement.

COMMITMENT OF THE INSANE TO ASYLUMS OR HOSPITALS. In many countries, and in most of the States in the Union, special safeguards are erected by laws to prevent the confinement of sane people in institutions for the insane, as well as to secure to the insane a full enjoyment of their rights. For instance, in the State of New York an alleged insane person may be committed to an institution for the reception and care of the insane only after a complicated, though not public, process. In this State the word asylum is used no longer, but has been replaced by the term hospital. There are no more 'keepers;' but nurses and attendants have the immediate care of the mentally astray. A Commission in Lunacy controls all matters relating to the insane. This commission is composed of a medical man of at least five years' experience in the actual care of the insane in an institution of some size, a lawyer, and a layman, all three appointed by the Governor of the State. These commissioners issue or revoke licenses to physicians or to State hospitals whereby they are permitted to conduct or forbidden to conduct institutions for the care and treatment of the insane. They also are charged with the duty of visiting all institutions, supervising, and in a sense directing their government. Any judge of a court of record may appoint as an examiner in lunacy a physician of whom he approves, who has been in the actual practice of his profession at least three years, and who is a permanent resident of the State. The commitment paper, as formulated by the New York State Commission, consists of five parts: (1) A petition, to be made by a member of the family of the alleged insane person, by a person living in the house with him, or by a county officer, setting forth the reasons of the petitioner for believing the person insane, and asking the court to act in the matter; (2) a certificate made under oath by two examiners in lunacy, giving the results of their joint examination of the patient; (3) a waiver of personal service of the order of court upon the person in question, to be signed by the committing justice in his discretion, or a substitutional service; (4) an order for a hearing before the justice, if in his opinion this be necessary or desirable, or be requested; (5) an order of a judge of a court of record committing the alleged insane person to the chosen hospital or retreat, after officially declaring him to be insane. In the case of indigent lunatics, who are partially or totally a charge upon the State, a further statement is made by the justice concerning the patient's financial condition, so far as can be ascertained. This entire proceeding may be concluded, with the exception of the *hearing*, without publicity or violation of the privacy that should surround family matters; yet it prevents a conspiracy to incarcerate a sane man as insane.

BIBLIOGRAPHY. Bucknill and Tuke, *Psychological Medicine* (4th ed., London, 1879); Hammond, *Treatise on Insanity* (New York, 1883); Spitzka, *Manual of Insanity* (New York, 1889); Bevan Lewis, *Text-book of Mental Diseases* (Philadelphia, 1889); Mercier, *Sanity and Insanity* (New York, 1892); Kirchhoff, *Handbook of Insanity* (New York, 1895); Church and Peterson, *Nervous and Mental Diseases* (2d ed., Philadelphia, 1901).

INSANITY. Technically, in law, a disease or disturbance of the mental faculties which may produce some effect on the legal character or quality of the insane person's acts. It may or may not render him *non compos mentis*, that is, subject to legal restraint or control of his person and property. It may thus be distinguished from lunacy, which may be described as such mental unsoundness as to incapacitate the insane person for all legal transactions and justify the State through the proper agency in taking charge of his person and property. The discussion of the legal control of the person and property of lunatics, or those who are *non compos mentis*, is reserved for the article on LUNACY. The law takes cognizance of insane persons as such, chiefly for the following purposes: (1) To ascertain their responsibility for crime; (2) to ascertain their capacity to make contracts; (3) to ascertain their liability for their torts; (4) to ascertain their capacity to make wills.

(1) Responsibility for Crime. The insanity of one charged with crime may preclude the existence of the criminal intent which is an essential element of the crime. When, therefore, the plea of insanity is set up on behalf of one charged with crime the question raised is, Was the accused capable of forming a criminal intent at the time when he committed the act? The law on this subject was first fully investigated, and a legal test of insanity in criminal cases adopted, in M'Naghton's case by the English House of Lords in 1843. M'Naghton, having killed another while under the influence of an insane delusion, was charged with murder and certain questions growing out of the case were put to the judges of the House of Lords. They answered in substance that mere insanity was not a defense; that to establish want of criminal responsibility it must be proved that the party accused was laboring under such defect of reason from disease of the mind as not to know the nature and quality of the act he was doing; that an insane delusion would not establish want of responsibility unless the delusion if true would justify the defendant in doing the act with which he is charged. Thus, one who killed another under an insane delusion that the other was threatening his life under circumstances of immediate danger to himself is not criminally responsible for the homicide; but an insane delusion that another was slandering the defendant would not excuse him for killing or even assaulting the supposed slanderer, assuming always that in other particulars the defendant knew the nature and quality of his act. M'Naghton's case still represents the law in England, and its rules have been adopted by the courts of most of the United States.

The effect of M'Naghton's case is to hold to full legal responsibility one who commits an offense under the influence of an insane, irresistible impulse, if he knew at the time the nature and character of his act. And this is generally the law, although it is conceded that there can be no criminal act without a free agent, and there may be in a given case the strongest evidence of the existence of such an impulse. The courts of a few States, however, relying on the assertion of medical experts that such a form of insanity does exist, recognize such a plea as a good ground of defense, but hedge about their ruling with the most stringent requirements as to proof of such mental defect. Idiocy or imbecility is also a defense to crime. The test adopted, viz. that one must have as much mental capacity as a child fourteen years old in order to be convicted of crime, is not very satisfactory, but is probably the best possible. So-called moral insanity and emotional insanity have never been recognized by the courts as a legal defense to crime.

One charged with a crime is presumed to be sane, and the prosecution is not in the first instance required to introduce evidence of sanity of the defendant. Upon the defendant's offering evidence to prove his insanity the burden of proving sanity is thrown upon the prosecution. Theoretically, since the effect of insanity is to show absence of criminal intent, the prosecution should be required to prove sanity beyond a reasonable doubt in order to establish criminal intent. In a few States this is the rule. In the majority, however, the defendant is required to prove his insanity by the preponderance of evidence, and in one or two to prove his insanity beyond a reasonable doubt. Insanity may also be a bar to the trial or punishment of one charged with a crime. The test of insanity in the one case is the defendant's ability to understand the nature of the charge and of the trial, and in the other the nature and purpose of the punishment.

(2) Capacity to Contract. The contracts of a lunatic, that is one for whom a committee has been appointed, are void, and no rights or liabilities are acquired under them either by the lunatic or the person dealing with him. The contracts of one who is insane, but who has not been judicially declared to be a lunatic by the appointment of a committee for the person or property, are in general voidable, i.e. they stand as valid until he or his legal representative set them aside. Formerly it was held that the law would not allow one to plead his own insanity in order to avoid his contracts, since he would by so doing stultify himself. This rule no longer obtains. If the insanity is of a character such as to prevent an insane person from understanding and reasoning properly with reference to the contract and its terms, and the insanity is known to the person dealing with him, then the contract may be avoided at the option of the insane person or his legal representative. If, however, the person dealing with him does not know of the insanity, and he have nothing to put him on his guard, the weight of authority is that such a contract cannot be avoided unless the sane party could be placed *in statu quo*. An insane person is absolutely liable for necessaries duly supplied to himself or his wife upon the theory of quasi-contracts (q.v.). See Necessaries.

(3) Liability for Torts. Justice and public policy require that insane persons should be bound to pay from their property for damage caused by their torts to others, and it is generally the law that insane persons are liable for their torts. In the case of malicious torts, as libels and slanders, insanity may render the mind incapable of entertaining malice, in which case there is no liability, and for the same reason insanity of a defendant may be a ground for not awarding punitive or vindictive damages. See Tort; Damages.

(4) Capacity to Make a Will. Insanity does not necessarily render one incapable of making a will. It is declared by the best judges that so high a degree of mental ability is not needed to make a will as is requisite to the formation of a valid contract. The criterion of testamentary capacity in this respect, as stated by the New York Court of Appeals in the celebrated Parish will case (Delafield *vs.* Parish, 25 New York 9, 35), has been generally accepted and acted on throughout the world. It is that the testator must be capable of understanding the nature of the business in which he is engaged, of summoning before his mind, without prompting, the property of which he wishes to dispose, and the persons who are the natural objects of his bounty, and of retaining them in his mind a sufficient length of time to arrive at a rational conclusion. The two salient elements of this

requirement are a retentive memory and the capacity to form a rational conclusion. A person's mind may be greatly deranged or somewhat enfeebled, and yet be sufficiently strong to meet this requirement. Insanity of a testator is also of importance in investigating the question of undue influence which under certain circumstances may invalidate a will. See WILL.

An insane person is a competent witness to testify to all matters about which he is not insane or mentally unbalanced. In dealing with questions of insanity courts concern themselves very little with the theories and speculations of psychologists and physicians, and no attempt is made to classify the various forms of insanity, except in the manner already indicated. The important question in every case is the mental competency and legal liability, according to the well-settled rules of law, of the person upon whose acts judgment is to be raised regardless of the precise cause or nature of his disorder. The fact of insanity must be established by direct evidence, and is usually established by experts, who are allowed great latitude in giving testimony as to the mental capacity of the alleged insane person. See EVIDENCE; LUNACY.

Consult the authorities referred to under LUNACY; MEDICAL JURISPRUDENCE.

INSATIATE COUNTESS, THE. A tragedy by John Marston (1603), sometimes attributed to Barkstead.

INSCRIPTIONS (Lat. *inscriptio*, from *inscribere*, to write upon, from *in*, in, upon + *scribere*, to write). The name applied to writings upon durable material, such as stone or bronze. Ordinarily such writings are engraved, but they may also be painted. The number and variety of the inscriptions of the past is very great, and the term is of course applied with equal correctness to the records on gravestones or other monuments of the present. The far greater use of inscriptions in ancient times, and the large variety of subjects upon which they furnish information, have made epigraphy, or the study of this class of monuments, an important branch of the science of antiquity. For many peoples the inscriptions are almost the only source of our knowledge of their history, language, and customs. This is the case with Babylonia, Assyria, ancient Persia, and to a very great extent with Egypt; the Lycian, Phrygian, and Etruscan languages are known only through the records on the monuments, and these are only a few examples of peoples revealed to us by inscriptions. Even where an extensive literature has been preserved in other forms, as in the case of Greece and Rome, the monumental records throw new light on the classic texts, and add numberless details, which enable us to fill out the picture of ancient life, of which the literature so often preserves only the outline. Inscriptions in the widest sense include the picture-writings of the North American Indians, the hieroglyphics of Central America and Mexico, and all the other forms in which man has endeavored to preserve his records upon indestructible materials. In many of these cases, however, the content of the record is either unintelligible or unimportant, and the interest centres in the form. These systems are therefore more appropriately described under WRITING. In cases where the inscriptions are the chief or only source for the life and history of their makers, or are noteworthy for the kind of writing employed, they are naturally discussed in connection with the lands from which they come or the characters used. Consult, therefore, the articles ASSYRIA; BABYLONIA; CUNEIFORM INSCRIPTIONS; EGYPT; ETRURIA; HIEROGLYPHICS; HITTITES; MINÆANS; SABÆANS.

The most ancient inscriptions are those found in Mesopotamia and in Egypt, and these countries have furnished by far the largest number of these records of Oriental history and civilization; but in their form and contents they extend beyond the domain of epigraphy, and are more properly treated under the special titles just mentioned.

Under Semitic inscriptions should strictly be included any inscription composed in a Semitic language. For practical purposes, however, the term is usually limited to such inscriptions as are written in the systems of alphabetic writing developed by Semites, and these systems furnish a convenient basis of classification. Two great groups may thus be distinguished: The North-Semitic, employing an alphabet of which the Phœnician is the type, and the South-Semitic, whose alphabet is represented by the modern Abyssinian character (Amhâric, Tigriña). The *North-Semitic* group is divided into two principal sections:

(1) The *Phœnicio-Palestinian*, including Phœnician, to which the Carthaginian, or Punic, both old and new, belongs, Hebrew, Moabitic, and Samaritan. (2) The *Aramaic*, which begins about the second century B.C. and later can be separated into Nabatæan or Sinaitic, Palmyrene, Syriac, and Mandæan. Not all of these groups are of equal importance, for in some cases the scanty epigraphic material adds but little to what is known from the literature, while in general it may be said that only the early documents are of special interest either in language, contents or form.

Though the published Semitic inscriptions are numerous, the great mass are brief records from gravestones, or isolated names, or graffiti, such as cover the rocks of the Sinaitic peninsula. The immense variety that characterizes Greek and Latin epigraphy is lacking here, partly perhaps because so few sites have been systematically explored. Two of the most important North-Semitic inscriptions, the Moabite Stone and the Siloam Inscription, are treated in separate articles. (See MOABITE STONE; SILOAM.) The most important Phœnician inscription is that on the sarcophagus of Eshmunazar, King of Sidon, now in the Louvre, which is probably from the end of the fourth century B.C. Earlier but shorter are the inscriptions of Eshmunazar's father, Tabnith, and of King Jechaumelech of Byblos, which may be as early as the fifth century B.C. The earliest writing of this group is probably on the fragments of metal cups from Cyprus, which seem to be even earlier than the Moabite stone, and may perhaps belong in the tenth century B.C. An important Carthaginian document is the long inscription in Marseilles, containing regulations regarding sacrifices, including the fees to be paid by the worshiper and the division of the victim with the priest. An important group is formed by the Aramaic inscriptions, now in Berlin, of Senjirli, in Northern Syria, some of which belong to the first half of the eighth century B.C., and throw an interesting light on the relations of these petty kings to Tiglath-pileser III. of Assyria, their suzerain. At Palmyra many inscriptions in the local alphabet have been found, for the most part mortuary, and dating from the first three centuries of our era. Of especial interest is a long bilingual, in Greek and Palmyrene, of A.D. 137, containing the customs, duties and tolls, which are recorded to obviate the frequent disputes between the caravans and the custom-house officials. Among the late inscriptions, especial interest attaches to a bilingual, Syriac and Chinese, in Western China, relating to the work of Nestorian missionaries in the region, about 781 A.D. The North-Semitic inscriptions are best discussed, and the important texts collected and illustrated in fac-simile, in Lidzbarski, *Handbuch der Nordsemitischen Epigraphik* (Weimar, 1898), which also contains a very complete bibliography. The inscriptions are collected in the still incomplete *Corpus Inscriptionum Semiticarum* (Paris, 1881 seq.), prepared under the direction of the French *Académie des Inscriptions et Belles-Lettres.*

The *South-Semitic* group of inscriptions, though but little known until comparatively recent times, have furnished valuable information in regard to the early history of Arabia, and their study has developed into a most important branch of Semitic research. This group may be provisionally divided into four sections: The *Safaitic*, the *Liḥjanian*, the *South-Arabian*, and the *Abyssinian.* (1) The Safaitic inscriptions, found in the neighborhood of Es-Safa, south of Damascus, are chiefly epitaphs and contain little more than the names and genealogies of the deceased whose memory they preserve. Apparently they do not antedate the first century of the Christian era. Consult: Halévy, *Essai sur les inscriptions du Safa* (Paris, 1882); Littmann, *Zur Entzifferung der Safâ-Inschriften* (Leipzig, 1901). (2) *Liḥjanian* is the name given to a class of inscriptions found in recent times at El-Oela, in Northern Hejaz, because the King of Lihjan (an Arabian tribal name) is mentioned in them as the ruler of the district in which they occur. They are not numerous, and the mutilated condition in which most of them have been found renders their interpretation extremely difficult. Their date is somewhat doubtful, but they seem to be contemporary with the rule of the Ptolemies in Egypt. Consult: D. H. Müller, *Epigraphische Denkmäler aus Arabien* (Vienna, 1889); Nöldeke, *Die Semitischen Sprachen* (Leipzig, 1899). Far more important than the two classes just mentioned are (3) the *South-Arabian* inscriptions, found principally in the southwestern corner of the Arabian peninsula. These inscriptions, which are very numerous, refer chiefly to the dedication of buildings or the presentation of various objects to the gods, and they throw much light upon the religion of the ancient Arabians. They contain, moreover, many valuable historical and geographical allusions, and enable us to reconstruct at least an outline of the history of the country for a period which, until recent years, has been involved in complete obscurity. The South-Arabian inscriptions exhibit several dialects, each possessing marked grammatical peculiarities. The oldest inscriptions are composed in the dialect of the *Minæans*, whose kings ruled over a large part of Arabia at least as early as the fourteenth century B.C., their influence extending as far north as the borders of Palestine. About the eighth century B.C. their dominion passed into the hands of the *Sabæans.* In these two dialects the great mass of the South-Arabian inscriptions are composed. The dialects of Katabân and Hadramaut, in the extreme southern part of Arabia, are represented by a few inscriptions. Both these dialects seem to have been more closely related to Minæan than to Sabæan. Of the large number of South-Arabian inscriptions collected by various explorers—notably by the Austrian scholar Eduard Glaser—a very considerable portion yet awaits publication. Consult: Weber, *Arabien vor dem Islam* (Leipzig, 1902); id., *Studien zur Südarabischen Altertumskunde* (Berlin, 1901); Winckler, *Musri, Meluḫḫa, Ma‘în* (Berlin, 1898); Glaser, *Skizze der Geschichte und Geographie Arabiens* (Berlin, 1889-90); Hommel, *Südarabische Chrestomathie* (Munich, 1893), contains a very complete bibliography of the subject, down to the date of publication. See also MINÆANS; SABÆANS. (4) The *Abyssinian* inscriptions, found at the ancient capital Axum, are few in number and belong to a late period. The earliest date from about 350 A.D., and are written in the Sabæan modification of the South-Semitic alphabet. In inscriptions of a later date (about 500 A.D.) the Ethiopic system of writing, as used in the manuscripts, is found fully developed. Consult: Bent, *The Sacred City of the Ethiopians* (London, 1893); D. H. Müller, *Epigraphische Denkmäler aus Abessynien* (Vienna, 1894); Glaser, *Die Abessynier in Arabien und Afrika* (Munich, 1895). See also ETHIOPIA.

In recent years considerable attention has been paid to the study of the *Hittite* monuments, which are found throughout Asia Minor as far west as Smyrna, though they occur most abundantly around the Bay of Iskanderun, in Cappadocia, in Cilicia, and in Northern Syria. In 1899 a long Hittite inscription was found at Babylon, whither it had been conveyed as a trophy. The Hittite inscriptions employ a species of hieroglyphic writing, the individual characters representing parts of the human body, animals, birds and other objects. In the older inscriptions the hieroglyphs are cut in relief, while in those of later date they are incised. Many attempts have been made to decipher these inscriptions, but, so far, with slight success. Professor Jensen of Marburg has at least made a beginning, and his identifications of ideographs and sign groups for various countries seem to rest upon solid grounds. He believes that the language belongs to the Armenian branch of the Aryan family, but the known facts are too scanty to warrant a definite conclusion upon this subject at present. Consult: Messerschmidt, *Die Hettiter* (Leipzig, 1902); *Corpus Inscriptionum Hettiticarum* (Berlin, 1900-02); Jensen, *Hettiter und Armenier* (Strassburg, 1898); Koldewey, *Die hettitische Inschrift gefunden in der Königsburg von Babylon* (Leipzig, 1900). See also HITTITES.

The Old Persian inscriptions are exclusively regal. The longest and most typical one is that at Behistun (q.v.), which recounts the life and deeds of Darius I. The shorter inscriptions of the same king, as well as of his successors, Xerxes I., and Artaxerxes I., II., and III., are more occasional in subject. They are in the main dedicatory tablets, set up at Susa, Persepolis, Elvand, Naqs-i-Rustem, and Suez. Like the Behistun inscription, these minor texts express a deep and unfeigned religious spirit. In style the Old Persian inscriptions show in many phrases the influence of the earlier Assyro-Babylonian tablets, although the freer Aryan spirit is manifest throughout. The Old Persian inscriptions have been edited several times. The best editions are by Rawlinson, "The Persian Cuneiform Inscription at Behistun," in *Journal of the Royal Asiatic Society*, old series x.-xi. (London, 1846); Spiegel, *Altpersische Keilinschriften* (Leipzig, 1881); Weissbach and Bang, *Altpersische Keilinschriften* (ib., 1893); Tolman, *Persian Inscriptions* (New York, 1892). Consult also the bibliography of CUNEIFORM INSCRIPTIONS.

Far more numerous than the remains of the Semitic peoples are the inscriptions in Greek and Latin. It was the custom of both peoples to record in this form all documents which it seemed desirable to bring or keep before the public eye. Hence, almost any excavation on a large scale brings to light a multitude of inscribed stones. The number of these monuments is entirely unknown; in 1891 Larfeld estimated the Greek inscriptions alone at 50,000, and the intervening years have brought large increase. The Latin inscriptions are far more numerous, and any estimate must be merely conjectural.

GREEK. The earliest inscriptions, if the primitive form of the letters does not mislead, are the rock-cut names of the island of Thera (Santorin), which may be dated in the seventh century. With these, though probably later, may be classed the rude names carved by the Greek mercenaries of King Psammeticus of Egypt on the colossi at Abu-Simbel. It is still a matter of dispute whether Psammeticus is the first (B.C. 654-617) or second (B.C. 594-589) of that name, but the analogy of other early inscriptions seems to favor the former date. The archaic inscriptions, written in local, or *epichoric*, alphabets, are tolerably numerous, but for the most part of interest and value chiefly for the history of the alphabet or the language, as they form one of the most important sources for the study of the Greek dialects. These early inscriptions are frequently written retrograde, that is, from right to left, or *boustrophedon* (βουστροφηδόν), that is alternately from right to left and left to right. By the end of the fifth century, the various local alphabets were generally superseded by the Ionic alphabet of Miletus, but the local dialects lived much longer. Progress of course varied with the locality. Crete, for example, long retained the ancient forms, and the longest and most important of archaic inscriptions, the laws of the Cretan Gortyna, in alphabet and dialect appears so primitive, that it is still placed by some scholars early in the sixth century B.C., though the weight of competent authority is in favor of a date in the last half of the fifth. The classification of Greek inscriptions is in the first place geographical. If the number of inscriptions from a locality is very great, or changes in the alphabet sharply marked, it is often found convenient to introduce chronological subdivisions. A good example is the arrangement of the collection of the Attic inscriptions, by which the first volume contains the inscriptions before B.C. 403, when in the archonship of Euclides the old Attic alphabet was officially replaced by the Ionian; the second volume includes the period from B.C. 403 to B.C. 31, the date of the battle of Actium, which was chosen for practical convenience rather than from any natural cleavage at this point, and the third embraces the inscriptions of the Roman imperial period. Such elaborate subdivision was needed in this case, because of the enormous mass of Attic inscriptions, which far exceed those from any other locality. Under the several localities, or periods, the inscriptions are grouped according to their contents. Two great groups may be distinguished, according as the inscriptions proceed from the governing body of the community, or from private individuals or associations. The *public* inscriptions include decrees and ordinances of all kinds, treaties, lists of magistrates and reports of official boards; they are naturally of the greatest value for the study of governmental institutions, and ancient communal life. Thus our knowledge of the details of the organization of the Athenian empire, the assessment of the tribute, and the relations of the subject-cities, rests in large part upon the records of the Hellenotamiæ, and the decrees of the Athenian assembly. The private inscriptions are even more inclusive, as they touch ancient life at almost every point. Mortuary inscriptions naturally form the largest class, but we have also many honorary inscriptions, and especially dedications to the gods. Here also belong the numerous records of manumissions, such as covered the wall of the portico of the Athenians at Delphi, in which the slave is by a legal fiction purchased by the god. An important group is composed of the records of private corporations, either business, religious or social. Of great value for the history of art are the numerous signatures of ancient artists, usually on the pedestals which once bore their works. See Loewy, *Inschriften Griechischer Bildhauer* (Leipzig, 1885). A curious example of a private inscription, which also illustrates the importance attached to this mode of publication, is furnished by Diogenes of Œnoanda, in Southeastern Caria, who recorded on the wall of a portico for the edification of his fellow-townsmen a long summary of the teachings of Epicurus, with letters and other quotations from the writings of the master. (See *Bulletin de Correspondance Hellénique*, xxi. 1897.) A detailed discussion of the characteristics of the several classes of Greek inscriptions does not lie within the scope of this article, but it will be well to add a brief notice of the material and the places used for these records. In general, stone, usually marble, is the material employed. Relatively very few of the Greek inscriptions are on bronze. In the case of graves, votive-offerings or honorary statues, the inscription is obviously an accessory, and the place is primarily determined by other conditions. For decrees, treaties, records of officials, royal letters, or any other documents for which publicity was desired, the market-place, or Acropolis, of a city, or the precincts or even walls of a temple, were the favorite places. The great sanctuaries, such as the Acropolis of Athens, Delos, Delphi, and Olympia were crowded not only with statues and works of art, but also with inscribed slabs of stone, often containing some vote of a distant community. The expense of private inscriptions was of course borne usually by the persons concerned, and public enactments were in like manner engraved at the expense of the State, but there are very many cases where the decree of a State or corporation honoring an individual was published in stone at the expense of the recipient, who in this way showed his appreciation of the honor conferred.

The value of these records as a source of information did not escape the ancient historians. Herodotus, Thucydides and Xenophon, as well as the orators, refer to them, but do not, as a rule, quote them directly, unless perhaps in citing the terms of treaties. But the systematic collection and use of inscriptions seems to begin at the end of the fourth century. The records of the public games and dramatic contests were utilized in compiling lists of victors, or in determining the chronology of plays. Attic inscriptions were collected by Philochoros (B.C. 320-261), while Polemo of Ilion, at the beginning of the second century, diligently gathered dedications, artists' signatures, and numerous other records from the Greek sanctuaries; his work is partly preserved in the guide-book of Pausanias. The Greek Anthology owes many of its poems to the collections of epigrams compiled from the monuments by earlier scholars. During the Middle Ages interest in Greek, and still more in Greek inscriptions, was almost unknown, and it was not till the fifteenth century that the study of Greek epigraphy secured the attention of scholars, who naturally were at first attracted by the more abundant Latin remains. Cyriacus of Ancona (q.v.) in his numerous travels in the Levant copied many inscriptions, but his zeal frequently outran his knowledge, and, in many cases, it seems only too clear that his ancient documents owe their origin to the classical authors, rather than to the stones. It was not till 1603, however, that an attempt at a complete collection of inscriptions appeared in the *Inscriptiones Antiquæ Totius Orbi Romani* of I. Gruter (2d ed., in 4 vols., 1707, by Grævius). In this and a number of similar works which followed, the inscriptions were grouped in classes, while the language and chronology were wholly neglected in the arrangement. Naturally the Latin inscriptions were in a vast majority. During the seventeenth and eighteenth centuries the attention of epigraphists was given rather to the acquisition of new material from the gradually opening Levant, which was visited by scholars sent out by the French Académie des Inscriptions et Belles-Lettres and the English Society of Dilettanti, as well as by numerous independent travelers, than to the compilation of complete collections. The vast increase in the material rendered such a collection a necessity, and in 1815 the Berlin Academy intrusted the preparation of such a work to August Boeckh. After ten years of labor the first part of vol. i. of the *Corpus Inscriptionum Græcarum* appeared, and the complete volume, which contained first the oldest inscriptions, important for their alphabet, and then those of Attica, Megaris, Peloponnesus, Bœotia, Phocis, Locris, and Thessaly, in 1828. Vol. ii. did not appear till 1843, nor vol. iii. till 1853, while vol. iv., though partly published in 1859, was not completed by the addition of the *Indices* till 1877. Though this work labors under what would now be considered serious defects, it laid the foundation, which alone made possible the development of the severely critical methods of modern epigraphists. Even before the appearance of the second volume, the increase in the material resulting from the independence of Greece and the active exploration of Hellenic lands showed that new collections would be needed, and before the completion of the work it was obvious that the projected supplement would be entirely inadequate to a proper publication of the new inscriptions. In 1871, therefore, the Berlin Academy entered upon the preparation of a new Corpus, which is still in course of publication. (See *Bibliography.*) Along with this gigantic collection of all the monuments, there has gone on the publication of many lesser collections, either inscriptions in a single museum, as the British Museum, or from single places, as Olympia and Pergamon, or noteworthy for their age or dialect, while all the archæological journals devote much space to the new material, which explorers, especially in Asia Minor, or excavators are continually bringing to light. In conclusion, brief mention should be made of the Greek inscriptions of Cyprus, which are written in part in a peculiar syllabic alphabet, wholly unlike the Greek, but possibly with affinities to some of the undeciphered syllabaries of Asia Minor, and of the use of Greek characters for inscriptions in non-Greek languages, such as Lycian, Phrygian, Carian, Pamphylian, and the unknown tongue represented by two inscriptions from Præsos on Crete. Though the values of the letters is generally certain, the languages themselves are not yet read with any certainty.

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LATIN. The earliest Latin inscriptions cannot rival the antiquity of the Greek. The gold fibula or brooch of Præneste is probably of the sixth century B.C., and some have claimed an even greater antiquity for the broken column of the Roman Forum, though the best authorities consider it scarcely older than the middle of the fifth century. Another early example, the so-called 'Duenos inscription' on a curious triple-bodied vase from the Esquiline, is very probably of the fourth century, but is still a puzzle to scholars. With very few exceptions, however, the Latin inscriptions are not older than B.C. 300. In its earliest forms the alphabet shows strongly its connection with the Greek, which reached the Romans from the Chalcidians of Cumæ, and, like other early attempts at writing, is marked by crude and variable forms for the letters. Later were developed the large square and handsome monumental characters (*scriptura quadrata* or *lapidaria*), which were carefully carved after preliminary tracing, and then colored, usually with red. Painted inscriptions, not carved, naturally show freer forms, and these were later often imitated in stone, as were sometimes the common cursive hands, which are found in wax tablets in *graffiti*, and often on domestic utensils of various kinds. The inscriptions are usually divided into two great classes: (1) *Tituli*, employed to designate some definite object, giving the needed information to distinguish it from similar objects; such are mortuary, dedicatory, and honorary inscriptions. (2) *Acta*, or documents, which are engraved for purposes of publication. The former are far more numerous, and show naturally a more stereotyped form. Among the mortuary inscriptions are noteworthy the many metrical epitaphs, often crude in metre and cold in expression, but also not infrequently showing tenderness and deep family affection. In general the classes of inscriptions are the same as recur in Greece, but one or two Roman customs may be mentioned. The person who erected a temple or any other public building was usually allowed to engrave his name upon it, and these *tituli* are a much more important class of monuments than in Greece, where this was not a usual habit. Such inscriptions are valuable sources of information as to the date and circumstances under which these works were constructed. The numerous milestones not only mark the course of the ancient roads, but show the distances and names of the chief towns, and the dates when the roads were built or repaired, and by whom the work was directed. For the *acta*, bronze seems to have been the favorite material before the time of Augustus, but later the Greek use of marble was commonly adopted. They include treaties (rare), laws, decrees of the Senate and, in great numbers, of various town councils and corporations, the edicts and letters of Roman magistrates, and especially of the emperors, and the numberless documents relating to the service of the gods. Among the Imperial edicts belong the military diplomas, or formal discharges which conferred on the retiring veterans special privileges. In connection with the service of the gods belong the calendars which were prepared during the early Empire. Here may also be mentioned the *Fasti*, or lists of consuls and other important magistrates, of which there are many remains. Among these religious inscriptions an important place is taken by the records of the Arval Brothers (q.v.), and the account of the great secular games of B.C. 17, with its mention of Horace's *Carmen Sæculare*. A special place is occupied by the great *Monumentum Ancyranum*, the account by Augustus of his deeds (*index rerum a se gestarum*), engraved in Greek and Latin on the walls of the temple of Augustus and Rome at Ancyra, in Asia Minor, after the original bronze tablets on the mausoleum of the Emperor in Rome. (See Mommsen, *Res Gestæ divi Augusti*, 2d ed., Berlin, 1883; Fairley, *Monumentum Ancyranum*, Philadelphia, 1898.) The Romans do not seem to have collected inscriptions as did the Greeks, though references to them are not infrequent in the histories, as Livy or Suetonius, and in other writers, from whom no complete collection has yet been made. At the very end of the ancient time and the beginning of the Middle Ages, when Rome became a place of pilgrimage, during the eighth and ninth centuries, many of the inscriptions were copied by visitors, and several of these compilations have been preserved wholly or in part, the most celebrated being the Anonymus Einsiedelensis. After the ninth century came a long period of neglect of the classical remains, and one of the first to revive these studies was the celebrated tribune of Rome, Cola di Rienzi, who about 1344 prepared a description of Rome in which he used the epigraphic material at his hand. Another collection was prepared in the early fifteenth century by the enthusiastic student of the past, Poggio Bracciolini, and from that time collectors of inscriptions are numerous, and at times decidedly unscrupulous. Latin epigraphy in the sixteenth century suffered from forgers, at whose head stands Pirro Ligorio, of Naples, and their work deceived many until its character was disclosed by the exact scientific criticism of the nineteenth century. The earliest printed collection seems to have been that of the inscriptions of Ravenna (1489). Gruter's great collection of 1603 has already been mentioned. (See under *Greek.*) It was followed by collections by Reinesius, Fabretti, and others, till Muratori published his *Novus Thesaurus Veterum Inscriptionum* (4 vols., Milan, 1739-42), which his lack of knowledge made of but little real service. The foundations for the modern study of Latin epigraphy were laid by the careful and minute investigations of Bartolomeo Borghesi (died 1859), who devoted his life to a study of the Fasti of Roman magistrates. A *corpus* of Latin inscriptions had been planned by the Berlin Academy, and also suggested by the French Academy; but the project was first realized when after a long period of preparation there appeared in 1863 the first volume, edited by

Theodor Mommsen and Wilhelm Henzen. Since then the work has steadily continued, though it is still incomplete, and from the nature of the case is always likely to be in need of supplements.

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INSECT (Lat. *insectum*, insect, from *insecare*, to cut in, from *in*, in + *secare*, to cut). In its strict sense, a member of a group of six-legged arthropods known as the class Insecta or Hexapoda. Vulgarly, the term is applied to almost any small crawling creature; and even among naturalists until comparatively recent years it was applied to the spiders and their relatives (Arachnida) and to the centipedes and thousand-legs (Myriapoda). Insects constitute by far the largest group of living creatures, and in fact form much the larger part of the land animals of the world. In number of species they are more numerous than all of the other groups of land animals together, while in number of individuals they are countless. The most conservative estimate places the number of species of insects in existence at five millions, while the estimate of Riley, the famous entomologist, was ten millions. They are extremely variable in their habits.

FOOD. The great majority feed upon vegetation of one kind or another, and practically every part of every living plant is liable to insect attack. They feed not only upon living vegetation, but also upon dead plant tissue in every stage of decay, and even upon soil mold wherever it occurs, and are largely instrumental in the rapid disappearance of dead vegetation. Thousands of species also prey upon animals of different groups, from the warm-blooded vertebrates down to creatures of their own class and the other lower forms of animal life. They feed not only upon living animals, as parasites and predatory enemies, but also upon dead animal matter of all kinds, including excrementitious substances, as well as upon fabrics and other things composed of animal material. Although predominating so enormously on land, insects lose their preponderance in water, yet very many species are aquatic during the whole or some portion of their lives.

RELATIONS TO MAN. The economic status of the group is difficult to decide. The damage which they do to human beings in one or another of very many direct and indirect ways is enormous, yet they are also beneficial to man in many other ways. Perhaps the most pronounced benefit derived from insects is in the cross-fertilization (q.v.) of cultivated crops. Without their agency in this direction the cultivation of many useful plants would practically be impossible, while in others the results obtained at present would be impracticable. The benefits derived from individual species—such as commercial silk from the silkworm, honey from the honey-bee, shellac from the lac-insect, cochineal from another scale-insect—are well known, and the functions of insects as soil-makers, and of thousands of the parasitic forms as destroyers of noxious insects, are most beneficial to the human species. It is as destroyers of cultivated crops, however, that insects are most commonly known, and it has been estimated that in the United States agriculture and horticulture suffer an annual loss of $300,000,000 from their work. Almost every cultivated crop has not only its thousands upon thousands of individual insect enemies, but is affected by scores and even hundreds of species. A tabulation of the insect enemies of the apple already recognized in the United States shows 281 species, of clover 82 species, and of so new a crop as the sugar-beet 70 species. The insects of the vine or the orange, of wheat, and in fact of all of the prominent staples, show equally startling figures. It is this damage done by insects injurious to agriculture that has given rise to the comparatively new branch of applied science known as economic entomology, which, although originating in Europe, has been encouraged to such an extent in the United States, owing partly to the greater necessities of a new country and partly to the practical turn of mind of the American, that there are more official economic entomologists employed by the States and by our general Government than in all of the other countries of the world together.

Aside from cultivated crops there is hardly any product of man's ingenuity which is not damaged directly or indirectly by insects—the timbers of dwellings, household utensils, clothes, nearly everything used as food, books, furniture, and drugs, and an infinite variety of other useful substances. They are very injurious to live stock and other animals; practically every species of animal which has become domesticated and is of value to man possesses its insect parasites and enemies. Some of them are general parasites of warm-blooded animals; others are specific to the animals or groups of animals which they affect. Horses, cattle, and sheep all have insect enemies which are not only very deleterious to their health, but frequently cause their death in numbers. The bot-fly of the horse lives in the larval condition in incredible numbers in the stomach and intestines of the horse. The bot-fly of the ox lives, in the larval stage, under the skin of the backs of cattle, and by its perforations ruins their hides for commercial use. The bot-fly of sheep inhabits the nasal and orbital sinuses of sheep and produces insanity and death. (See BOT.) The horn-fly, the numerous gad-fly, including the tsetse-fly of Africa, the screw-worm fly of the Southwestern United States (qq.v.), and many others, seriously hinder the efforts of the owners of live stock.

INSECTS AND DISEASE. As annoying man himself, insects play an important part, since there are very few regions of the habitable globe where man is not troubled by them. Bedbugs, fleas, lice, the itch-mite, the screw-worm fly, mosquitoes (qq.v.), and many other species unite in this method of damage to the human species. It is, however, as carriers of disease that insects are perhaps of the greatest importance in their relations to the human species. The filaria diseases of the East (elephantiasis, chyluria, and lymph scrotum) are transferred by certain mosquitoes; the Texas fever of cattle in the United States, the red-water diseases of Africa, and other cattle fevers are transmitted by certain ticks; the tsetse-fly of Africa carries the micro-organisms of disease; the purulent conjunctivitis of the Egyptians and Fiji Islanders is communicated by the house-fly; the eye disease, known as 'pinkeye' in the Southern United States, is transported by minute flies of the genus Hippelates. Asiatic cholera and typhoid fever are carried by the house-fly; and it is claimed that the bubonic plague is spread by fleas. All forms of malaria are carried about by mosquitoes of the genus Anopheles (see MOSQUITO), and yellow fever by those of the genus Stegomyia. (See MOSQUITO.) It has also recently been claimed that dengue fever is in Syria spread by a mosquito of the genus Culex; that Anthrax bacilli in malignant pustules in human beings are caused by the bite of flies of the genera Tabanus and Stomoxys; and that the famous 'surrah' disease of cattle in Oriental regions is also carried by gad-flies.

POISONOUS INSECTS. Certain insects may be considered under this head which poison human beings in any one of several different ways: (1) They may have a sting which is a modified ovipositor, and which is connected with a specific poison-gland, as with the bees, wasps, stinging ants, and certain other Hymenoptera. (2) There may be a modified salivary gland which has a poisonous secretion and is connected with a piercing beak, as with certain bugs of the order Heteroptera, and as with many dipterous insects like mosquitoes and other biting flies. (3) The hairs covering the body surface may be modified into sharp bristles, which may be simple or barbed, and which, when coming in contact with the skin of human beings, produce an urticating or nettling effect. Poisonous insects of this group are confined to the caterpillars or larvæ of certain moths, especially of the family Limacodidæ, and, to a much less marked extent, a few of the caterpillars of Bombycidæ, such as *Orgyia leucostigma*, *Euproctis chrysorrhœa*, as well as to a few of the Saturniidæ, like the larva of the Io moth. (4) Certain beetles when crushed produce a blistering effect upon the skin. These are confined to the family Meloidæ or blister-beetles (q.v.).

The poison of bees is formed by the mixture of the secretions of two glands, one of which is acid and the other alkaline. With the burrowing wasps the alkaline gland is absent or atrophied, and the poison consists only of the acid. The effect of the sting of these wasps is to stupefy the prey and not to kill it. It results that the insects stung remain in excellent condition as food for the larvæ of the wasps for a considerable length of time. (See WASP.) The severity of the sting of the aculeate Hymenoptera and the amount of poison injected into the wound differ with different species. The sting of our large mud-wasp (q.v.) is especially severe, and as a rule the stings of wasps have a more poisonous effect upon human beings than the stings of bees. There are cases on record where many bee-stings on the same individual have produced death. Several instances have been well authenticated by medical men of the death of a human being from a single sting of a wasp, the sting acting as a very powerful irritant poison on the nerve-centres of the patient. As a rule such cases are confined to exceptionally nervous individuals, to those inheriting gouty tendencies, who are remarkably susceptible to the action of certain medicines. Persons handling bees and wasps become immune to their poison; the stings have little effect upon them. This immunity, however, disappears in the absence of continuous reinoculation. This fact is well known to beekeepers, and entomologists who collect wasps and other stinging Hymenoptera in large numbers have called attention to the same fact. The remedy for the stings of both bees and wasps is the immediate application of an alkali.

Many of the poisonous flies are treated of under MOSQUITO; GAD-FLY; and BLACK-FLY.

The true bugs which give a poisonous bite with a piercing beak, and which may attack man, belong almost entirely to the family Reduviidæ (see CONENOSE), to which the terms 'pirate-bugs' and 'kissing bugs' are applied. The Eastern species are *Opsicœtes* (or *Reduvius*) *personatus*, *Melanolestes picipes*, and *Melanolestes abdominalis;* and the principal Southern and Western forms are *Rasahus biguttatus* and *Conorhinus sanguisugus.* (See the article CONENOSE.) The bite of these bugs is specifically poisonous, but the great inflammation which so often occurs is doubtless due to the entrance into the circulation of germs of putrefaction, since the bugs are attracted to dead animal matter. The Eastern species (*Melanolestes picipes*) is a shining black bug rather more than a half inch in length. The principal Western species (*Rahasus biguttatus*) is reddish in color with blue-black fore wings, each marked with a round reddish spot. This latter species is, according to Davidson, the cause of nearly all of the supposed cases of 'spider-bites' in the Southwest.

ECOLOGY. As a class, insects are represented in practically all parts of the world. While flourishing more abundantly in the tropics, they are found in countless numbers in the temperate regions, and are also very numerous in boreal regions. They abound inside the Arctic Circle, and in the short Arctic summer many species of nearly all orders may be collected. As a rule, as with other classes of animals, the forms occurring in tropical regions are larger in size and more brilliant in color. Many groups are confined to the tropics; others have a wide geographic distribution. The value of the class Insecta in the study of the geographic distribution of life is very great with certain groups, while others have comparatively slight faunistic value. Civilization exerts a direct and destructive influence upon the insect faunas of large regions. Insects being largely dependent, directly or indirectly, upon vegetation, the destruction of the wild flora and sylva and the introduction of cultivated crops almost immediately change completely the characteristics of a given insect fauna. The rapid development of methods of transportation, and especially intercommunication between remote regions, by means of the constantly increasing number and speed of vessels, has resulted in the accidental introduction and acclimatization of many hundreds of species of insects into regions remote from their original homes, many of which succeed in establishing themselves. The facility of acclimatization varies greatly with different groups, and this facility is dependent upon the degree of simplicity of the life of the insect and upon the degree of simplicity of its natural environment. So great has become the danger of the introduction of injurious species from one country to another during late years, that many nations seek to protect themselves by special quarantine measures.

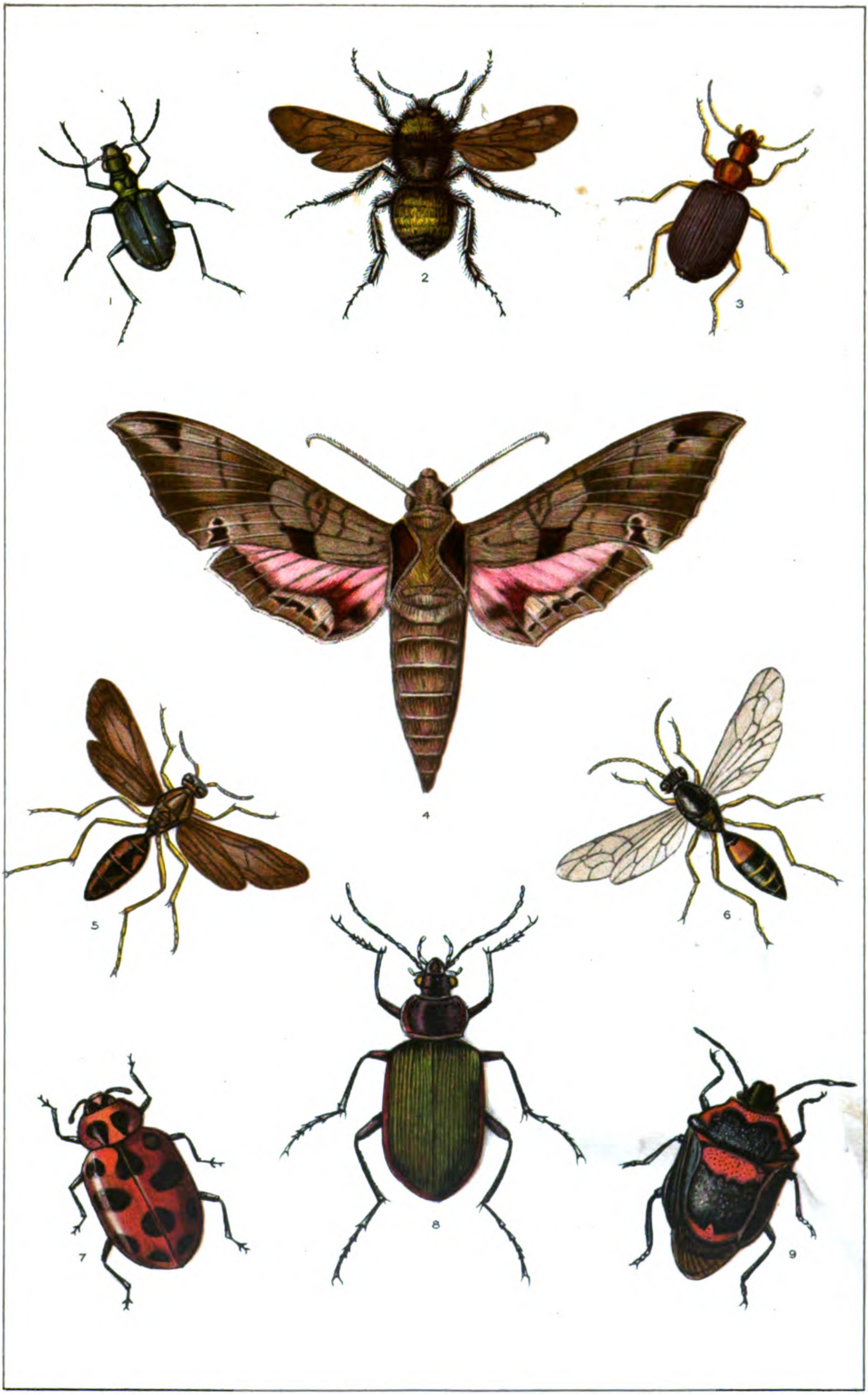
From what has preceded, it is evident that insects, in spite of their small size and their consequent slight strength, have been remarkably successful in the so-called struggle for existence. They have a long geological history, and the insects of Tertiary rocks are in some instances almost generically related to living forms. Rapidity of growth and power of multiplication have been prime factors in this persistence, while the relations which exist between circulation and respiration have been almost equally significant. In many instances the growth from the egg to the individual occupies only a few days, while in some species a single female will lay several thousands of eggs. The functions of circulation and respiration are so related that nutrition can be carried on very rapidly and very efficiently. By the phenomenon of metamorphosis, growth and development are isolated from one another, allowing growth to go on unchecked and uncomplicated by development.

The social life of insects is very remarkable; organized societies are formed with many species, especially the Hymenoptera (bees, wasps, and ants) and the Isoptera (white ants or Termitidæ). In these societies great numbers of individuals live together and are greatly modified in structure in accordance with the different functions which they perform in the community. See ANT; BEE; WASP; TERMITE; and *Social Insects*, below.

REPRODUCTION. Nearly all insects undergo in the course of their lives remarkable changes in form. A few forms are ovoviviparous—that is, bring forth living young, but the great majority lay eggs. (See EGG.) With some forms there is a development without metamorphosis, and in these the young insect just hatched from the egg is of the same form as the adult insect. With others there is what is termed an incomplete metamorphosis—that is to say, where, although the young greatly resemble the adult, there is still a striking change of form during life. With others still there is what has been termed a complete metamorphosis (q.v.), in which the young just hatched is strikingly different from its subsequent stages. With the bees, butterflies, flies, beetles, and other insects, the form which hatches from the egg, and which is known as the 'larva,' is a 'grub' or a 'caterpillar.' This, after reaching full growth, passes into another form, which is known as the pupa, and in which in the majority of cases the insect is quiescent, while from this stage there eventually emerges the perfect insect. Larvæ grow by molting; the skin is more or less hard and is composed of chitin; a new skin is formed beneath the old skin, which eventually bursts and permits the larva to emerge. The number of molts differs with the larvæ of different groups and ranges from two or three to as many as twelve or more. The phenomenon known as hypermetamorphosis sometimes occurs. With certain of the blister-beetles, for example, the first larvæ which are born possess legs, by the aid of which they can cling to a bee and be carried to its nest, where they will live on the food stored by the bee; after a molt they lose their legs and become almost organless, floating about in the honey. Later still, another form of larva is found. See METAMORPHOSIS (in Animals); LARVA; PUPA.

SOCIAL INSECTS. A great many insects lead solitary lives. Others, either as larvæ or as adults, are gregarious, and in gregarious feeding and gregarious life we have the beginning of social communities. Many lepidopterous larvæ, or caterpillars, feed together in great masses, like the army worm (q.v.) of the United States, and

INSECTS



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JULIUS BIEN & CO. LITH. N.Y.

1 SIX-SPOTTED TIGER BEETLE - CICINDELA SEX-GUTTATUS
2 AMERICAN BUMBLEBEE - BOMBUS AMERICANUS
3 POTATO-BUG ENEMY - LEBIA GRANDIS
4 ACHEMON SPHINXMOTH - PHILAMPELUS ACHEMON
5 CLOAKED WASP - POLISTES PALLIPES
6 ICHNEUMON FLY - ICHNEUMON JUCUNDUS
7 SPOTTED LADYBIRD - MEGILLA MACULATA
8 GREEN CATERPILLAR-HUNTER - CALOSOMA SCRUTATOR
9 BORDERED PLANT-BUG - STIRETRUS ANCHORAGO

NOS. 1 AND 8 SOMEWHAT ENLARGED, NO. 3 ENLARGED NEARLY TWICE, NOS. 7 AND 9 GREATLY ENLARGED

more especially the larvæ of certain silk-spinning moths, like the European processionary moth (*Cnethocampa processionea*), and less markedly the American tent caterpillar and fall webworm (qq.v.). These tents or webs for community feeding are carried to a higher degree of perfection in the European tineine moths of the genus Hyponomeuta, and still more perfectly in the community nests of a tropical butterfly (*Eucheira socialis*). A number of moths make communal cocoons, but nearly all of these are tropical. The beginning of a true communal life is seen with the ambrosia beetles (q.v.) of the family Scolytidæ. These are beetles which make galleries under the bark of trees, apparently cultivating a fungus which they use as food, preparing a bed for its cultivation; they also carefully remove excrement from the fungus gardens and practically bury their dead. The most perfect socialism, however, occurs among the bees, wasps, and ants of the order Hymenoptera, and among the termites or so-called 'white ants' of the order Isoptera. Not all bees are social. A large group is composed of solitary bees. Among the social bees a more or less primitive social life is found with the bumblebees. Here there is a communal existence. Nests are made, cells are constructed for the young, the young are fed by the adults, and there is a separation into three castes, viz. females, males, and drones. There is also the beginning of a separation of the drones into two castes, the larger ones in general attending to the mending of the covering of the nests and to the ripening of the honey, while the smaller ones for the most part do the inside housework, such as the wax-repairing and the nursing of the young. The community life of the hive or honey bee is much more complicated than that of the bumblebee, but the workers seem to be more uniform in their duties. The stingless tropical bees of the genera Trigona and Melipona form very large communities, some of them even exceeding in size those of the honeybee, but the social life is practically the same. See **Bee**.

The wasps are also both social and solitary. The social species belong for the most part to the genera Vespa and Polistes. Their communities are much like those of the social bees. They are, however, not so perfect and not so persistent as those of the true honey-bee or the ants, but resemble more nearly those of the bumblebee. The communities of the bumblebees and the wasps are annual. Those of the honey-bee and the ants, as well as of the termites, last for a number of years. Among the wasps is a form known as worker, just as with the social bees, and the workers here, as in the other cases, are undeveloped females. Here also, as with the social bees, these undeveloped females or workers may lay eggs which invariably produce males or drones. Most of the social wasps make paper cells and nests, using for this purpose a wood-pulp composed of fragments of wood moistened with saliva, and macerated in the mouth. The economy of the social wasps is not perfectly understood, doubtless owing to the difficulty of studying them, due to the irritability of the insects and to their poisonous stinging. The size of the communities varies at the season when they are largest, from a few individuals to many hundreds, as many as 1200 cells being found in a single nest. On the approach of winter the males and workers perish and the fertile females crawl into such protected situations as crevices of walls and in the bark of trees, and there pass the winter in the dormant state. At the opening of spring each surviving female founds a new colony. At first she performs the duties of both queen and worker. A small nest is made, eggs are laid in it, and when the larvæ hatch they are fed and cared for by the queen until they are mature. This first generation is composed entirely of workers. They relieve the queen of the duties which belong to them, and from this time forth her only duty is to lay eggs. The workers are engaged in the enlargement of the nest, in the construction of new cells, and in the care of the young.

With the ants we come to a more complicated social life. Here not only do great numbers of separate individuals live together and adopt different functions, according to the positions which they occupy in the colony, but these individuals are also greatly modified in structure, and in their physiological processes, in such ways as to fit them especially for the parts they have to play. With the different families of ants the character of the colony differs very considerably. For a general account of the community life of the higher families and the general phenomena of ant life, see **Ant**; also **Driver Ant**; **Foraging Ant**, etc.

The family Poneridæ, as pointed out by Wheeler, constitutes a primitive and generalized group of ants, wherein the colonies consist of a comparatively small number of individuals like the incipient colonies of the higher families. These small colonies appear to be annual growths formed by swarming, as in bees, and not by single fertilized female ants, unaccompanied by workers, as in the higher families, and as described under **Ant**. Two and more colonies of the same species can be fused to form another colony without much difficulty, which is not easily accomplished with many species of the more specialized ants. Their architecture is of a primitive character, consisting of a few irregular and unfinished galleries. The queen and worker differ but little in size and structure. Ergatoid females, or forms intermediate between the queens and the workers, are of normal and comparatively frequent occurrence in some species. The habits of the queen and worker are very similar; the female is not an individual to whom especial attention is paid by the workers. The workers show no tendency to differentiate into major and minor castes. They are carnivorous and live by hunting, in contrast with the various harvesting, fungus-growing, honey-collecting, and aphid-guarding members of the higher groups. They do not feed one another by regurgitation; nor are the larvæ fed by regurgitation, but are given pieces of insects, from which they suck the juices. It is fair to suppose that from such generalized beginnings the highly specialized and wonderful colonies of the higher groups of ants have sprung, and that the slave-making habits, the care of honey-producing insects, the differentiation of a soldier caste, the fungus-growing habit, and others have been developed by gradual evolution.

The phenomenon of polymorphism (q.v.) becomes very marked with ants, although it reaches a still higher development among the termites. The causes of the modifications seen in the different castes are still in dispute. Dewitz states that the caste is already determined in the insect before leaving the egg; Weismann associates the caste with some hypothetical rudiments existing at the very earliest stage of the embryonic process; Herbert Spencer and others believe that the character of the insect is determined by the nutrition of the larva, just as is the case with the honey-bee. The chief forms of polymorphism in ants are the ordinary winged male, the ergatoid male, the winged female, the ergatoid fertile female (a form intermediate between female and worker), the soldier, the worker major, and one or more kinds of worker minor. In addition to these there are apparently cases of females with post-metamorphic growth in the Dorylides, but these have not yet been the subject of investigation. The fact that the social insects in which the phenomena of caste or polymorphism occur, though belonging to very different groups, all feed their young, is suggestive and lends weight to the theory that the differentiation is the result of character of the larval food. Emery accounts for this differentiation by assuming that it has been gradually acquired by numerous species and that we now see it in various stages of development; also, according to Sharp, "that the variation in nutrition does not affect all the parts of the body equally, but may be such as to carry on the development of certain portions of the organization while that of other parts is arrested."

The so-called intelligence of bees, and especially of ants, has been a subject of wonder and comment on the part of many writers for hundreds of years. The observations of Lubbock, however, indicate that bees have not the high degree of intelligence with which many writers have credited them, and that in this respect they do not compare with the higher ants, which are ranked as the highest in point of intelligence among social insects. Riley, in his work entitled *Social Insects from the Psychical and Evolutional Points of View*, expressed himself as of the opinion that no one can doubt the possession by the social insects of intelligence, of conscious reasoning and reflective powers. He makes the statement, "We can never properly appreciate nor properly bring ourselves into sympathy with these lower creatures until we recognize that they are actuated by the same kind of intelligence as ours." Bethe (1898), however, in discussing the question as to whether or not we may ascribe psychical qualities to ants and bees, points out the danger of the observer injecting his own personality into the subject investigated. He shows, for example, that while we *see*, all we know about bees and ants is that they are influenced by the light, and that it would be most unscientific to say that they do anything as highly psychical as seeing, until it is proved. Some of the peculiar and apparently highly intelligent things which ants do, such as recognizing the enormous number of members of the same colony, and such as finding their way to their own nests and to food-supplies and communicating intelligence of the location of food-supplies from one to the other, have been carefully tested by Bethe, who concludes that he can find nothing in the phenomena exhibited by bees and ants to prove the existence of any psychical qualities. Lubbock thought that he had proved that ants communicated with one another, but Bethe used one of Lubbock's own experiments to show that it proved nothing. He concludes that they learn nothing, but act mechanically in whatever they do, "their complicated reflexes being set off by simple physiological stimuli." See facts under this head in article INSTINCT.

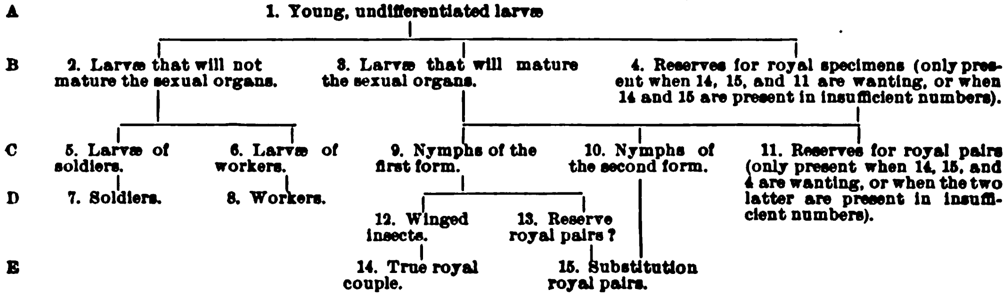
In the termites or 'white ants' we reach a very specialized form of the social or community life of insects. They reach their highest development in tropical regions; the females or queens grow to be of enormous size, the abdomen swollen with eggs sometimes becoming as big as a potato, or twenty thousand or thirty thousand times the bulk of a worker. The eggs may be laid at the rate of 60 a minute or 80,000 a day. The species are all social, and communities consist of both wingless and winged individuals. The winged individuals are with most species excessively numerous, and as a rule they are divided into two castes, namely the ordinary workers and the soldiers. The so-called soldiers also exist with the true ants, but they have not in these creatures become such a structurally well-differentiated caste as with the termites. In the latter the jaws have become enormously developed, and in some cases the soldier is five times the size of the worker. In some species some of the workers have branched off into another caste, the 'nasuti,' in which the head has become elongated into a long nose-like process, at the tip of which is a hole through which is exuded a fluid which is used in making and mending the walls of the habitation. Although the social life of a termite colony is superficially much like that of an ant colony, the development of the social habit and the differentiation of forms have taken place along entirely different lines: the termites have an incomplete metamorphosis; the ants have a complete metamorphosis; the young of the termite is more or less capable of self-support soon after birth, whereas the larvæ of the bees and ants are entirely helpless during development, and are fed by the adults. The fundamental difference between the two groups is that with the termites the workers or neuters, including the soldiers, are not undeveloped females, as with the workers and soldiers of the ants, and the workers of the bees, but they consist of both sexes and are in reality the arrested or modified larvæ in which the sexual organs are imperfectly developed or are completely atrophied.

With the hive-bee, multiplication of colonies takes place by division, but the colonizing swarm carries with it a queen, and thus the foundation of a new colony is easy. With the higher termites multiplication of colonies also takes place by division, but this is carried out by the workers and soldiers which travel away and capture one of the royal pairs that wander about after they have swarmed and thrown off their wings. Many colonies of termites will be found in which there is no queen. Among the different species of termites there is a marked gradation from a simple to a more complex economy. The continuance of a termite community is entirely dependent upon the king and queen, which are the adult individuals of both sexes which have swarmed and lost their wings. There is usually but a single pair in a nest, and they are frequently inclosed in a cell which they cannot leave. In consequence of the disorganization of the community if anything happens to the king or queen, termites keep certain individuals in reserve in such a state of advancement that they can rapidly be developed into kings and queens should occasion require it.

When such individuals, however, are developed to meet the emergency, they are generally immature in the anterior parts of the body. The termite queen differs in one respect from any other known insect—that is, in actual growth after reaching the adult stage, this growth being confined to the abdominal region of the body, and being due to the necessity for an extraordinary number of eggs.

The complicated character of a termite colony is seen from the following table (from Sharp), which indicates the numerous forms which exist in certain communities:

FORMS OF TERMES LUCIFUGUS (After Grassi)


A
1. Young, undifferentiated larvæ
B
2. Larvæ that will not mature the sexual organs.
3. Larvæ that will mature the sexual organs.
4. Reserves for royal specimens (only present when 14, 15, and 11 are wanting, or when 14 and 15 are present in insufficient numbers).
C
5. Larvæ of soldiers.
6. Larvæ of workers.
9. Nymphs of the first form.
10. Nymphs of the second form.
11. Reserves for royal pairs (only present when 14, 15, and 4 are wanting, or when the two latter are present in insufficient numbers).
D
7. Soldiers.
8. Workers.
12. Winged insects.
13. Reserve royal pairs ?
E
14. True royal couple.
15. Substitution royal pairs.

A very remarkable feature of the life of social insects is the frequent occurrence, in the colonies of almost all species, of 'guests,' or inquilines. Insects of several orders live in ant colonies and symbiosis (q.v.) presents itself here under various aspects, among which, according to Wasmann, real hospitality (myrmetoxenie and termitoxenie) and relations of friendship (symphylie) take first rank, and as far as we can tell, are unequaled elsewhere in the animal kingdom. Wasmann has studied more than a hundred different species of insects living in the nests of ants, and more than a hundred different species in the nests of termites, but states that these form but a fraction of those hidden in the nests of tropical ants, and jealously guarded by their 'jailers.' New and interesting discoveries are constantly coming to light in the tropics. Certain of the beetles found in these nests possess certain peculiar tufts of hair and are licked by the hosts on account of the pleasant secretion which comes from them. The peculiarly shaped antennæ of the guests indicate that they summon the ant at feeding time by tapping it with these organs. Certain rove-beetles occurring in termites' nests are fed directly by their hosts. Many of the guests are curiously modified so as to present a striking resemblance to their hosts. With those living with blind ants the form is not modified, but the structure and the hair growths have become similar to those of ants. Among these guest insects (which when occurring in ants' nests are known as 'myrmecophilous' and in termites' nests as 'termitophilous'), there are representatives of no less than 31 different families of Coleoptera, seven families of Hymenoptera, several families of Lepidoptera, Diptera, Orthoptera, Neuroptera, Pseudoneuroptera, Hemiptera, Thysanura, and there are also living as guests in these nests certain curiously modified myriapods, scorpions, spiders, mites, and isopod crustaceans. See INQUILINE; TERMITE.

STRUCTURE OF INSECTS. The insects are most closely related to the myriapods and to the spiders and their allies (Arachnida). The body consists of not more than 21 segments, which are usually of unequal size and shape, arranged in three usually well-defined regions—head, thorax, and abdomen. The head is small and flattened or rounded, and is composed of not less than six segments, bearing eyes and at least four pairs of appendages, namely one pair of antennæ and three pairs of mouth-parts. The mandibles are one-jointed, without appendages. There are two pairs of maxillæ, the first pair separate, usually three-lobed and with a palpus which is never more than six-jointed. The second pair unite to form the under lip and bear a pair of palpi never more than four-jointed. The epipharynx forms the roof of the mouth and bears taste organs. The hypopharynx is usually well developed, and lies on the under side of the mouth just above the labium, and receives the end of the salivary duct. There is a pair of compound eyes, and usually from two to three simple eyes (ocelli). The thorax consists of three segments. There are three pairs of legs, each foot ending in a pair of claws; two pairs of wings, a pair to each of the two hinder thoracic segments. The wings are occasionally reduced or wanting in forms which, however, had winged ancestors. The abdomen consists at the most of from ten to twelve segments, and there are no functional abdominal legs except in the Thysanura and in the larvæ of Lepidoptera. The genital openings are usually single, but are paired in some orders.

The digestive canal is highly differentiated in the winged orders. In larvæ it is a nearly straight tube extending from one end of the body to the other. In adult insects, however, it is usually much longer than the body, and therefore is more or less folded. It is situated below the dorsal vessel and above the ventral chain of nerve-ganglia. There are three main divisions, namely the anterior, middle, and posterior. The anterior and posterior divisions are morphologically considered as invaginations of the extremities of the skin. The œsophagus is usually narrow, dilating behind to form the crop. Sometimes it dilates immediately behind the mouth, and this dilatation is known as 'pharynx.' It is followed by the 'gizzard' or proventriculus. The true stomach or chylific ventricle is always present, and is very variable in shape and size. Sometimes it is coiled like an intestine, and sometimes bears pouches varying in number from two to very many. The intestine varies greatly in length, being smaller anteriorly and frequently widening to form a rectum. There is sometimes a cæcum and odoriferous glands. The alimentary canal has two coats of muscles, a longitudinal and transverse coat. Salivary glands are present in many insects, discharge into the mouth, and vary greatly in their development. The silk spun by many larvæ comes from long silk-glands similar in form and situation to the simple tubes of the salivary glands. Malpighian tubules are present in most insects in the hinder end of the body, opening into the alimentary canal usually at the junction of the stomach and intestine. They vary greatly in length and number.

The nervous system consists of a well-developed brain, and no more than thirteen pairs of ganglia which may be more or less confused in the specialized orders. The cephalic ganglia are placed above the œsophagus, while the other ganglia are ventral. There is an accessory sympathetic system which is complex and difficult of dissection. Respiration is carried on by means of a system of air-vessels called tracheæ, which ramify through all parts of the body. These tracheæ connect with the outer air through a series of spiracles which are orifices at the side of the body, there being usually one pair for each segment. The tracheæ are elastic and consist of an outer cellular coat and an inner chitinous layer, the latter strengthened by a spiral fibre. With some insects, as with certain bees and locusts, the tracheæ expand in places to air-sacs, and these sacs, as well as the finest capillary branches of the tracheæ, lack the spiral fibre.

Circulation is carried on through the dorsal vessel or heart, which is situated in the upper part of the body (just beneath the dorsal skin), extending from the head or thorax to the posterior extremity. It is an elongate tube consisting of a number of united chambers, and is usually closed behind but open in front, having also several orifices at the side. There is a muscular layer with internal and external membranous layers. The blood is forced forward into the body-cavity, receiving oxygen from the terminal branches of the tracheæ. The muscular system is extensive, nearly four thousand muscles occurring in certain caterpillars.

Classification. According to the generally accepted classification, there are nineteen orders of insects, as follows:

Thysanura, springtails and bristletails.
Ephemerida, May-flies.
Odonata, dragon-flies.
Plecoptera, stone-flies.
Isoptera, white ants.
Corrodentia, psocids and book-lice.
Mallophaga, bird-lice.
Euplexoptera, earwigs.
Orthoptera, grasshoppers, crickets, etc.
Physopoda, thrips.
Hemiptera, true bugs, plant-lice, scale-insects.
Neuroptera, aphis-lions, ant-lions, etc.
Mecoptera, scorpion-flies, etc.
Trichoptera, caddis-flies.
Lepidoptera, butterflies and moths.
Diptera, true flies.
Siphonaptera, fleas.
Coleoptera, beetles.
Hymenoptera, bees, wasps, ants, saw-flies, etc.

Representatives of the principal of these groups are illustrated by typical forms on the accompanying colored plate, which are described in detail elsewhere, under their respective names. See also colored plates of Beetles, Butterflies, Dragon-flies, and Moths.

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INSECTA (Lat. nom. pl., insects). A class of six-legged arthropods, equivalent to the Hexapoda. See Insect.

INSECTICIDE (from Lat. *insectum*, insect + *-cida*, murderous, from *cædere*, to kill). A substance used by man to kill insects. Besides those materials properly included by this definition, however, there are many other agents of great importance as insect exterminators, of which the following may be classed as natural controls: Changes of temperature at critical times in the life histories of insects; rain, flood; drought; forest and prairie fires; bacteria, fungi, mites, spiders, predaceous and parasitic insects, and other invertebrates; fish, reptiles, birds, ant-eaters, and other vertebrates. Though each of these exercises an important function in checking insect depredation, their offices are beyond the scope of the present article, which deals with artificial or man-applied controls.

For convenience of discussion the classification of insecticides may be made according to the two ways by which insects obtain food. Plant-feeding insects either chew plant tissue by means of movable jaws or else suck the juices through punctures in the epidermis made by their tube-like beaks. The chewing species may be subdivided into those that feed beneath the surface and those that feed in exposed positions. To the concealed feeders belong the leaf-miners, which live beneath the epidermis of leaves, etc., and the borers in living and dead plants, timber, and grain. The only way these may be controlled are by poisonous gases (bean-weevil), by drowning (peach-borers, sometimes), burning infested parts (raspberry cane-borer), or by digging them out (apple-borer), the feasible method depending upon the habit of the species. To the exposed feeders belong caterpillars, grasshoppers, beetles, etc., which are usually controlled by intestinal poisons, such as arsenical compounds, especially Paris green used at the rate of a pound in from 100 to 300 gallons of water, Bordeaux mixture. (See Fungicide.) Another popular poison is arsenate of lead, which adheres to the foliage better than Paris green, and may be applied in larger quantities with less danger of injury. Of the newer insecticides, green arsenoid is considered valuable. Hellebore is most frequently used upon small plants, especially for the currant-worm. It is also sprayed upon fruits approaching maturity. Some soft-bodied insects may be controlled in the same way as sucking insects.

Sucking insects, among which are some of the most destructive pests of crops, cannot be controlled by stomach poisons, because they obtain their food from beneath the epidermis of the plant. Because of their small size, insidious habits, enormous prolificacy, or capability of withstanding treatment, they are among the most dreaded crop pests. Some (e.g. the squash-bug) have never been effectually and economically controlled by any method yet devised. In general the most feasible controls are such as either obstruct the respiratory passages of the insects (tobacco and insect powder), or have a caustic action upon their skins (kerosene and whale-oil soap). Since kerosene can rarely be applied with safety to growing plants, it is emulsified by mixing and churning violently two gallons of kerosene with a solution of eight ounces of hard soap in one gallon of hot water, and diluted when needed for use with from five to ten times as much water. Experiments have been made with pumps that mix kerosene and water in definite proportions as they are drawn from two respective tanks by the one piston-stroke. If successful, such pumps will save much disagreeable labor. Whale-oil soap is applied as a solution of one pound in one to ten gallons of water. Certain insects, notably the San José scale, a serious pest of woody plants, and the chinch-bug, an equally troublesome pest of cereals, have been experimented upon in a unique way; diseases were spread among them, in the first case by means of infected water sprayed upon them; in the latter by infected insects. Results were not particularly satisfactory in either case. Not so in the case of the cottony cushion scale, a pest on citrus trees in California. A ladybird beetle, imported from Australia, in a few years extirpated the pest. This is perhaps the most notable instance of man's utilizing a natural control and making it an insecticide in the narrow sense. See LADYBIRD.

Certain species of insects (clothes-moths and granary insects) may be best destroyed by suffocation in the fumes of carbon disulphide evaporated in shallow dishes placed at the top of the air-tight receptacle containing the material to be fumigated. An ounce to 50 or 75 cubic feet is the usual proportion, the box being kept closed for twenty-four hours or more. Since the fumes of carbon disulphide are very explosive, lights must be kept away. Hydrocyanic-acid gas is also largely used to suffocate insects, especially certain greenhouse and nursery stock pests, and the groups known as scale-insects, notably the San José scale. The gas is generated from potassium cyanide (98-99 per cent. pure) in a mixture of sulphuric acid and water, the proportions being 1 oz. cyanide of potassium, 2¼ oz. water, 1½ oz. sulphuric acid for each 100 cubic feet for nursery stock operated upon; 125 cubic feet for trees, granaries, flour-mills, and rooms; and 250 cubic feet for greenhouses. The usual exposures are from half an hour to an hour for plants and trees, according to whether they are growing or dormant, and 12 to 24 hours for rooms, etc. Since both the gas and the salt from which it is made are virulent poisons, no person who is not both careful and competent should employ them.

The insects that attack domestic animals and man, though individually serious pests, form a numerically insignificant group when compared to the great group of plant-feeding species. Hogs and sheep may be freed from lice by greasy mixtures and tobacco or carbolic washes; infested horses and cattle should be thoroughly curried once a week until the animals are free, the brush being dipped frequently in kerosene emulsion diluted with five or six parts of water. Similar remedies apply to the related parasites of the human subject, vaseline or lard being substituted for the kerosene emulsion. For the body-louse and the crab-louse hard boiling of infested clothes for half an hour or longer is essential, since the eggs are very resistant. Poultry may be kept free from lice by a liberal supply of fine dust, and their houses by fumigation with carbon disulphide or hydrocyanic-acid gas once a week and the frequent application of kerosene and whitewash. Carbolic soap is a standard insecticide against fleas in pet animals. With animals of all kinds, however, cleanliness is a great safeguard, since the insects which arrive first are destroyed before they have a chance to breed.

IN'SECTIV'ORA (Neo-Lat. nom. pl., from Lat. *insectum*, insect + *vorare*, to devour). An order of placental mammals, containing about 250 species, arranged in two suborders—(1) true Insectivora; (2) Dermoptera. The former includes the hedgehogs, tenrecs, moles, and mole-like animals, elephant shrews, true shrews, and the like, and the latter the 'flying lemur' (Galeopithecus). None of the Insectivora are of large size; most of them are small timid creatures, generally nocturnal in their habits, and useful in the economy of nature chiefly in preventing the undue increase of worm and insect pests. Although many of them are not exclusively insectivorous, all of them have the summits of the molar teeth beset with small conical tubercles, well adapted for breaking up the hard coverings of insect prey. Their dentition is characterized by a distinct tendency toward suppression of the milk dentition, but otherwise is variable. The legs are short, and the feet of most of them are plantigrade. The cerebrum is small and smooth, and does not cover the cerebellum. The order is regarded as one of the inferior, and among the most ancient, of the mammalian groups; and, with the exception of a single genus (Solenodon, of Cuba), they are now confined to the Northern Hemisphere, and to South Africa and Madagascar, i.e. to Artogæa. The most recent and advanced review of the order is Dobson, *A Monograph of the Insectivora* (London, 1886-90).

IN'SECTIV'OROUS PLANTS. Plants that catch and assimilate insects as part of their food. See CARNIVOROUS PLANTS.

INSECT POWDER, PYRETHRUM, BUHACH, DALMATIAN OR PERSIAN INSECT POWDER. A brownish-yellow powder obtained by grinding the dried flower-heads of two species of Chrysanthemum (Pyrethrum), a genus of plants of the natural order Compositæ. The species employed are *Chrysanthemum coccineum*, popularly known as *Pyrethrum roseum*, and often grown as an ornamental summer-bedding plant, and *Chrysanthemum cinerariæfolium*, also called *Pyrethrum cinerariæfolium*. From the flowers of the former, a Persian species, is made Dalmatian or Persian insect powder—better known in Europe than in America; from those of the latter, a Caucasian species, extensively cultivated in California, is manufactured the insect powder buhach and pyrethrum, common in the United States. When fresh the powder made from each species seems to be equally effective; but since the volatile oil, upon which their effectiveness depends, is lost with age and also by exposure to air and heat, the California product is considered with more favor in America than the imported powder. *Chrysanthemum cinerariæfolium* is preferred in California, because its flowers may be gathered at approximately one time, whereas *Chrysanthemum coccineum* has an extended period of bloom. The volatile oil acts upon insects by asphyxiation; upon man and other animals it has no serious effect; workmen in the pyrethrum-mills suffer no more inconvenience than millers do from the dust in flour-mills. The plants are fed to horses and other stock after the flowers have been gathered. In California, where some large farms are devoted wholly to this plant, the industry commenced in 1870, and three years later the small product was sold at $16 a pound. In 1885 the price had fallen to $0.45 a pound, and has never since risen to unreasonable figures. The seed is sown about half an inch deep in light soil during autumn or spring, and the young plants transplanted when a few inches tall to the field, 2 feet by 4 feet apart, given irrigation each month during the dry season, cultivated by horse, and kept free of weeds by hand. A partial crop may be obtained the first year after planting, but the crop of the third year is usually the largest. Generally the plants continue to bear profitably for six years. The flowers are combed from their stems by hand during May and June, sun-dried, and ground between burr-stones similar to those of old-fashioned flour-mills, and after bolting packed in air-tight tin cans. Insect powder is usually employed in household use as dust. When flies, mosquitoes, and other insects are numerous and troublesome, it is often heated in closed rooms and the stupefied creatures swept up and destroyed before they recover. It is similarly used in greenhouses. Frequently also it is applied as a solution in water (1 ounce to 2 or 3 gallons) or in alcohol (1 ounce to 4 ounces by weight). The former is applied as mixed; the latter, after daily shaking for a week or more, is filtered and the clear liquid applied with an atomizer. This decoction, if applied to plants, should be diluted somewhat. Pyrethrum is also sometimes mixed with kerosene emulsion or other insecticides. See INSECTICIDE.

INSECTS, FOSSIL. Of all animals the insects, with their aërial habits of life, would seem at first thought to be the least liable to entombment and preservation in a fossil state. They are, however, found in great abundance in several localities where the nature of the deposition was particularly favorable to their fossilization. These deposits are nearly all of fresh-water (lacustrine or marsh) or of estuarine origin, though some few are purely marine. As a rule the imbedding materials are finely grained shales or limestone concretions in shales, or fossil gums and amber; the amber has furnished by far the most perfect fossil insects known. The shale beds of the Oligocene Tertiary at Florissant, Colo., are also noted for the abundance and perfection of their insect contents. Other noted repositories of fossil insects are the Carboniferous coal-measure beds of Commentry, France, described by Brongniart; the Liassic beds of Schambelen, Switzerland, of Dobbertin, Germany, and of Gloucestershire, England; and the Jurassic lithographic limestone of Bavaria. The Tertiary localities, from which great numbers of insect remains have been derived, are the Baltic provinces of Germany and Russia, where they occur in amber; the shales of Aix, France, Florissant and the White River District of Colorado, and Oening, Radoboj, and Parshberg. The wings seem to be preserved as fossils far more often than other parts of the insect body, and in many formations these are the only parts found.

The known fossil insects do not present any great points of difference from those now living. Those found in the Mesozoic and Tertiary rocks can be readily placed in modern families; but all Paleozoic insects show a certain general resemblance, with here and there points of relationship to the orders of modern insects. These orders did not become fully differentiated until Triassic time, although ancestral forms are easily distinguishable among the earlier members of the class. The Paleozoic insects have on this account been grouped under the name of Palæodictyoptera, a synthetic group, and have been distributed, according to their resemblances to modern forms, among several orders—the Orthopteroidea, Neuropteroidea, Hemipteroidea, etc., which are directly ancestral to the Post-Paleozoic and modern orders of Orthoptera, Neuroptera, Hemiptera, etc. The Paleozoic insects are of more primitive type, as illustrated chiefly in the wing-structure, than are the Mesozoic insects. As a rule their front wings are membranous—i.e. they had not yet evolved hardened front wings, such as the elytra and tegmina, that serve as protective coverings for the more delicate hind wings of modern insects. Some of the early insects were of gigantic size, compared with their living descendants—Meganeura, an ancestral dragon-fly found in the Carboniferous of Commentry, France, had a body 16.5 inches long, and its wings spread over 28.5 inches. Another point of interest is that the Paleozoic insect fauna was made up almost entirely of cockroaches. These must have swarmed in the woods and swamps of the Carboniferous and Triassic periods, for their remains are found in abundance in the shales and sandstones associated with the coal deposits of those ages.

The earliest insects are of very fragmentary nature. The oldest known is supposed to be an ancestor of the bedbugs (Protocimex) found in the Ordovician rocks of Sweden and represented by a single wing. In the Silurian the cockroaches appeared, and they were the predominating types in the Devonian and Carboniferous. The Carboniferous fauna consists principally of Orthoptera and Neuroptera, and of forms intermediate between these two orders, and also of extinct types intermediate between the Orthoptera and the Hemiptera, and it is interesting because of its large number of generalized or synthetic types. In the Triassic the beetles appear suddenly with their characteristic hardened front wings fully developed. This difference in the character of the front and hind wings is fully marked for the first time in all Triassic insects, and it has become more strongly marked since that period. In the Liassic epoch of the Jurassic period insects were abundant, as might be expected from the general extension of terrestrial conditions during that period. Beetles abound, and as they represent many families still living, they have been used to determine the conditions of life and climate during that period. Leaf and fungus eating beetles and dung-beetles are known. The earliest ants; first well-marked bugs, allies of the squash-bug; the first flies, bees, and perhaps also the earliest moths, are found in this epoch. The Cretaceous insect fauna is small, but that of the succeeding Tertiary, beginning with the Eocene, is almost as well differentiated as that of the present day, for many of the genera are still members of the living insect fauna. In all about 3000 species of fossil insects are known, and these are distributed among the geological eras as follows: About 10 per cent. are Paleozoic, 15 per cent. Mesozoic, and 75 per cent. have been described from the Tertiary formations.

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INSECTS, PROPAGATION OF DISEASE BY. Careful observation and patient investigation have resulted in establishing the fact that the transmission of disease, in many instances hitherto unexplained, has been due to the agency of insects. The most momentous medical discovery during the year 1899 was that of the cause of malaria in human beings. There are several scientists to whom credit is due in the matter; but the lion's share of it belongs to Patrick Manson, of Dublin, and Major Ross, a surgeon in the British Army, stationed at Calcutta. During several years of laborious work they forged the links that completed the discovery. As long ago as 1807, Crawford, an American physician, suggested the possibility of the transmission of malaria to man by the mosquito. Again, in 1848, Nott, of New Orleans, referred to the part played by insects in propagating malarial fever. In 1883 A. F. A. King (q.v.), of Washington, D. C., reiterated the theory at some length. Laveran (q.v.), who, in 1880, discovered the *plasmodium malariæ*, or *hæmosporidium*, the parasite of the disease, declared in 1891 his adherence to the mosquito theory, as did also Flügge in the same year. In 1892, Pfeiffer showed that certain protozoa, called *coccidia*, which are found as parasites in the rabbit, are capable of two cycles of development, one being exogenous. He mentioned that Koch (q.v.) had suggested that a similar condition might hold good for the parasite of malaria, and that exogenous malarial spores might be conveyed to man by the agency of blood-sucking insects. In 1894 Manson, of Dublin, appeared as a vigorous supporter of the mosquito theory as best calculated to explain the various conditions of the problem. He drew a parallel between the malarial parasite and the *filaria Bancrofti*, which he had investigated very thoroughly. He suggested that the female mosquito fills herself with infected blood, deposits her eggs, and dies beside them. The water in which she lies becomes contaminated with the spores developing in her body, and is then drunk by men, or the spores are inhaled with dust from dried puddles, or the larvæ after being hatched feed on the dead body of the mother, and thus become carriers of infection, or the ground may become infected by the bodies of mosquitoes that die and fall upon it. Ross's work in his studies of malarial organisms in birds' blood is really monumental. He discovered that after a special variety of gray mosquito had fed on the blood of birds containing a certain mature organism called *proteosoma*, the stomach wall of the insect always contained certain pigmented *coccidia* two days later. After other changes had occurred on the eighth or ninth day, the coccidia ruptured and set free innumerable thread-like bodies which are distributed by the blood-current of the mosquito through her tissues. Eventually these bodies are found in certain glands in the thorax of the insect, whose ducts open at such a point as to furnish secretion that lubricates the lancets of the mosquito. When she punctures the skin of her victim, this secretion, containing the thread-like bodies, is injected into the bottom of the wound. Manson and his pupil, Daniels, proved that these thread-like bodies, or germinal spores, develop into mature proteosomata in a bird bitten by the infected mosquito, thus completing the cycle. While Manson was conducting his experiments, Grassi, the distinguished Milanese, was completing his studies on the mosquitoes of Italy. In 1898 he determined that *Anopheles claviger* was the variety that carried malarial infection. A man who had never been subjected to malarial infection was exposed to the bites of the mosquito *Anopheles claviger*, and in a short time began to suffer from malarial fever. Quinine cured him of the attack. The Italian scientists Bignami, Bastianelli, and Grassi, working in conjunction, arrived at the conclusion that the malarial hemisporidia (which consist of small reproductive cells produced within a cyst) run through a cycle in man which is characterized by a long amœboid stage and an absence of the encapsulated phase, reproducing themselves a great number of times during the completion of this cycle, and also giving rise to forms which remain sterile in man, known as Grassi's gameti. These latter forms, taken into the stomach of the *Anopheles* with the blood she draws from an infected man, develop into sporozoa, and these in turn form sporozoites, delicate filaments which find their way to the salivary glands of the *Anopheles*. The saliva anointing the lancet of the *Anopheles* carries the infection to the next victim bitten. In East and Central Africa experiments were made by Daniels which led him to believe that *Anopheles funestus* (Giles) is the chief agent in distributing malaria in that country, and that man is the only intermediate host of the malarial parasites.

A practical confirmation of the mosquito theory resulted from the labors of Low, Celli, Grassi, and the Red Cross of Italy, which demonstrated in 1901 that the use of the mosquito-net and the draining of stagnant pools prevented malaria in individuals living in notoriously malarious countries. Covering the surface of stagnant water with a pellicle of crude petroleum suffices, in many instances, to kill the larvæ of the mosquito and decrease of malaria follows. A solution of permanganate of potash, one to 1500, was found to be as effective, though not as cheap, as petroleum. It has been ascertained that goldfish may be used as the agent for the destruction of the larvæ of mosquitoes, as they eat them eagerly.

Extensive and important studies in New Jersey established the facts that the most abundant species of mosquitoes in that State, *Culex sollicitans*, breeds not only in brackish and salt water, but also in water that is 25 per cent. more salty than ordinary sea-water; that it does not breed in fresh water at all; that adult mosquitoes may be found in great abundance from 20 to 40 miles from their breeding-places; and that mosquitoes occur from 5 to 15 miles off shore, over the open ocean, at points to which they have been carried by the wind. *Culex pungens*, next in abundance to *Culex sollicitans*, was found breeding in every place where water is not salt. The breeding time for these mosquitoes is late in the fall, and the adults hibernate.

In the opinion of the expert observers who have investigated the matter, the mosquito is also responsible for the transmission of yellow fever. This theory was first advanced by Dr. Carlos Finlay, of Havana, in 1881. Reed, Carroll, Agramonte, and Lazear, who formed the commission appointed in 1900 by the Surgeon-General of the United States Army to investigate yellow fever in Cuba, concluded that the mosquito serves as the intermediate host for the parasite of yellow fever and that it is highly probable that the disease is propagated only through the bite of this insect. *Culex fasciatus*, which is identical with *Culex tiniads* (Giles), is the mosquito that acts as host for yellow fever. No less an authority than Dr. John Guitéras, formerly an opponent of this theory of the transmission of yellow fever, has become its earnest advocate. The mosquito has a part, also, in the dissemination of leprosy. Kaposi has instanced a case of this disease, easily traceable to a mosquito-bite. The experiments of Alvarez, as quoted by Carmichael, support this theory of mosquito transmission in leprosy. It is admitted without reserve that filariasis is transmitted by mosquitoes. Corroborative experiments and studies in the development of *filaria nocturna* were made by Low, of Rome, Italy, in 1901. He found active filaria embryos in the thoracic muscles of *Culex terriatus* between twelve and twenty-four hours after this mosquito had fed on a patient suffering from filariasis. In *Culex fasciatus* he found perfected filariæ in the head, neck, and proboscis. Elephantiasis has been transmitted by the mosquito. Its parasite was found in their bodies by the investigations of the Liverpool School of Tropical Medicine in Nigeria, Africa, in 1900.

The *fly* is properly charged with the transmission of many diseases. Nuttall fed the bacillus of the bubonic plague to flies, and ascertained that they convey the infection to man. Carmichael believes that leprosy is communicated by the same insect. The bacilli of anthrax (malignant pustule) have been found in flies. Grassi, of Milan, and, much later, Beale, of Calcutta, demonstrated that cholera was a fly-borne disease, and the germs of typhoid fever are carried by the same insect which swarms over fæcal evacuations. Hervieux, of France, ascribed the spread of smallpox to flies. Simond's investigations, carried on during 1899, together with the results obtained by Yersin, favor the theory of the spread of plague from rat to man by the *flea*. Bœck charges the *itch-mite* (q.v.) with being an active agent in the spread of leprosy. Smith and Kilbourne established the fact that the *tick* propagates Texas fever among sheep. The bacilli of anthrax have been found in *earthworms*.

Kobler's experiments led him to accuse the *ant* of carrying the infection of bubonic plague to man. From a sheep that died of anthrax, in Cyprus, in 1901, ants transmitted the fatal disease to a woman in a cottage near by. *Roaches* are believed to carry typhoid fever in the same way as do flies. The *bedbug* is responsible for the spread of leprosy (Carmichael), cancer (Moran), tuberculosis (Denevre), and relapsing fever (Titkin).

Insects, it is seen, propagate diseases in two ways: (1) As carriers, bringing infection to a wound or to food and drink on the surface of their bodies, after crawling over an infected spot, or bringing the infection in the form of bacilli in their intestinal tracts; (2) as intermediary hosts, bringing to the victim the infection in the fluids of their bodies and inflicting wounds through which the poison is introduced into the body of the victim. The mosquito is a true intermediary host. Flies and fleas are examples of carriers. Coplin, of Philadelphia, experimenting in the line of the researches of Sangres, caused roaches, flies, and bedbugs to walk over cultures of various disease germs and then to walk over sterile agar plates, many hours later, having been kept in the meantime in large jars, under as natural conditions as possible. Examinations of the agar plates made subsequently showed active cultures of the various bacilli of infection. The feet, the ventral portion of the body, and the wings of insects carry infection and plant the disease organisms in rows and small colonies throughout the surface of the sterile plates. Forty-eight hours of continuous infectivity was shown in the case of many disease germs thus transmitted. In one case the typhoid bacilli carried on the body of a roach retained their virulence for ninety-six hours.

But one germicide has proved of avail in disinfecting bacteria-laden material, and this is formaldehyde. The great difficulty in rendering harmless the insect carrier of disease is easily appreciated.

Consult: Ross, *Malarial Fever: Its Cause, Prevention, and Treatment* (Liverpool, 1902); Low, *Papers on Malaria and Filariasis* (Georgetown, Demarara, 1901); Cornoldi, *La mosca e il colera* (Venice, 1884); Beale, *Cholera a Fly-Borne Disease* (Calcutta, 1897); Moore, "Flies and Disease," in *Medical Magazine* (London, 1893-94); Howard, "Carriage of Disease," in *Miscellaneous Results* (Washington, 1901); Nuttall, *Hygienic Measures in Relation to Infectious Diseases* (New York, 1893); Grassi, *Die Malaria* (Jena, 1901); Celli, *Malaria According to the New Researches* (London, 1901); Liverpool School of Tropical Medicine, *Memoir III., Report of the Malarial Expedition to Nigeria* (Liverpool, 1901).

INSID'IOUS FLOWER-BUG. A minute heteropterous insect (*Triphleps insidiosus*) common in the United States. It belongs to the family Anthocoridæ, closely related to the bedbug family (Cimicidæ), is black with yellow-tipped wings, and is often found in flowers. It is predatory in its habits, feeding upon other insects, is a voracious foe of plant-lice, lace-bugs, and other minute creatures, and an important enemy of the grape-vine phylloxera.

INSIGNIA, Military. See Military Insignia.

INSOLATION. See Heatstroke.

INSOLVENCY (from *insolvent*, from *in-*, not + *solvent*, from Lat. *solvere*, to solve, relax, from *se-*, apart + *luere*, Gk. λύειν, *lyein*, to loose). As a legal term, the legal status of (1) any one who cannot pay his debts as they mature; (2) one who has been brought within the jurisdiction of the insolvency laws. The earliest insolvency statute in England is ch. 20 of 22 and 23 Charles II., passed in 1670. Its preamble recites: "Forasmuch as very many persons now detained in prison, are miserably impoverished, either by reason of the late unhappy time, the sad and dreadful fire, their own misfortunes, or otherwise, so as they are totally disabled to give any satisfaction to their creditors, and so become, without advantage to any, a charge and burden to the kingdom, and by noisomeness (inseparably incident to extreme poverty) may become the occasion of pestilence and contagious diseases, to the great prejudice of the kingdom." It is apparent from this preamble that the cruel fiction that a person was guilty of a breach of the peace who failed to pay a judgment debt, and the inhuman practice, attendant thereon, of arresting and imprisoning the debtor, had worked badly and threatened to produce a pestilence. Hence Parliamentary interference, making provision for debtors' securing release from 'durance vile,' upon surrendering any remnant of property they might have, and making an oath to their poverty and their honesty. This was the beginning of remedial legislation, which, within the last century, has resulted in abolishing imprisonment for honestly contracted debts.

From 1670 to 1861 insolvency statutes, insolvency proceedings, and insolvency courts were entirely distinct from *bankruptcy* (q.v.) statutes, proceedings, and courts. The leading features of English bankruptcy laws were: (1) They applied to traders only; (2) proceedings under them were instituted by creditors for the compulsory distribution of the debtor's assets; (3) such proceedings resulted in the discharge of the honest bankrupt from his debts. On the other hand, insolvency statutes (1) applied to all debtors; (2) proceedings under them were voluntary, that is, were instituted by the debtor; (3) they might result in discharging the insolvent's body from jail, but they left his future acquisitions liable for old debts.

In 1861 the bankruptcy statutes were extended to include non-traders, and insolvency proceedings were abolished. Since that date, insolvency, as distinguished from bankruptcy, means that a man has ceased, or is unable, to pay his debts as they come due. In this country the sharp distinction between the two terms which existed in England until 1861 has never been sanctioned by either legislative or judicial usage. Speaking in general terms, we may say that bankruptcy has been applied to statutes on the subject passed by Congress, and to proceedings thereunder; while insolvency has been applied to State statutes dealing with insolvent debtors. Even prior to the Revolution, the Colonies were accustomed to legislate for the relief of debtors, but their statutes, although providing at times for the discharge of the insolvent from all his debts, after the manner of bankruptcy statutes in the mother country, were called insolvency statutes. After the adoption of the Federal Constitution, with its grant of power to Congress to establish uniform laws on the subject of bankruptcies, it was natural that the colonial nomenclature should be continued by the States, even when adopting comprehensive bankruptcy statutes, such as have existed for many years in a number of the States. These laws, as has been stated in the article on Bankruptcy, were not abolished by the Federal statute of 1898, but their operation, so far as it conflicts with that of the Federal law, is suspended.

State statutes relating to insolvency have been very divergent, and from some points of view very unsatisfactory. They may be divided roughly into five classes, although in some States statutes falling within two or more of these classes will be found: (1) Simple insolvency laws; (2) statutes regulating general assignments for the benefit of creditors; (3) those providing for the distribution of the estates of insolvents for their discharge from debts, in voluntary proceedings only; (4) those providing for discharge from debts under general assignments; (5) true bankruptcy statutes, applying to all debtors and providing for voluntary and involuntary proceedings. As the States are prohibited from passing any law impairing the obligation of contracts, and as State legislation cannot operate to discharge a debtor from liabilities to creditors outside the State, without their consent, such legislation can never perform the functions of a Federal bankruptcy law. Consult: Bishop, *Treatise on the Law Relating to Insolvent Debtors* (New York, 1895); and "Insolvency Legislation," 35 *Canadian Law Journal*, 179.

INSOMNIA (Lat., sleeplessness), or Sleeplessness. A condition caused by cerebral excitation, mental or physical exhaustion, toxic conditions (as from alcohol or from disordered digestion), grief, etc. It frequently accompanies febrile conditions. It is best treated by attacking and removing the cause, if this can be ascertained. Hygienic measures, as hot baths, massage, ingesting hot food, applying heat to the extremities, ventilating the sleeping apartment, etc., should be tried before resorting to drugs, to overcome the condition. See Hypnotics; Sleep.

INSPECTION (Lat. *inspectio*, from *inspicere*, to look in, from *in*, in + *specere*, to look; connected with Gk. σκέπτεσθαι, *skeptesthai*, Skt. *spaś*, *paś*, to look, OHG. *spehōn*, Ger. *spähen*, to spy). Military inspections are carried out by specially appointed officers of the inspector-general's department. (See Inspector-General.) One of the duties of the inspecting officer is to inspect and report upon the appearance, discipline, and efficiency of the troops; to do which the troops are drawn up for inspection, which is one of the most formal of military ceremonies. The staff officers of the colonel form a line equal to the front of the column, the non-commissioned staff officers three paces in rear, the color guard three more paces in rear of the centre. The colonel, lieutenant-colonel, and staff officers, as soon as inspected, return swords, and accompany the inspector. Each major with his staff officers accompanies the inspector through his battalion. The inspection either precedes or follows a review, for which see REVIEW. Less formal but more frequent inspections are held from time to time by commanding officers of companies, battalions, regiments, and even larger commands, in order to insure the proper discipline and condition of the equipment, quarters, etc.

INSPECTOR-GENERAL. A military officer, charged with certain duties and responsibilities of inspection. In the United States Army he is at the head of the inspector-general's department, which in 1902 consisted of one inspector-general with the rank of brigadier-general, three with the rank of colonel, three with the rank of lieutenant-colonel, and three with the rank of major. Officers of this department are responsible to the Secretary of War for the proper inspection of troops, including their strength, efficiency, and equipment; stations; accounts of disbursing officers; irregularities or misconduct of officers; attempts to defraud the Government; all matters pertaining to the supervision of the accounts of receipts and expenditures in connection with the National Home for Disabled Volunteer Soldiers; all depots, armories, arsenals, and public works of every kind under charge of officers of the army, except works of engineering conducted under the direction of the Secretary of War, and supervision of the chief of engineers. Such inspections only cover the business and military administration and methods, and do not include the scientific or technical character of the work. Inspectors-general and acting inspectors-general are required, in addition to the above duties, to make such suggestions as may appear to them practicable for the correction of any defect that may come under their observation in any command to which they may be assigned. They are also expected to designate, from time to time, the articles which, in their opinion, should be procured and kept for sale by the subsistence department to officers and enlisted men. The annual inspection of the Soldiers' Home in the District of Columbia is made by the inspector-general of the army in person. In the English Army the title has reference to the special duties of (a) officers on the headquarters staff, Horse Guards (q.v.), London, inspector-general of auxiliary forces, inspector-general of recruiting, inspector-general of remounts, inspector-general of fortifications, and inspector-general of cavalry; (b) general officers commanding territorial districts, and other commands, who personally or through the officers of their staff inspect the component parts of their commands. In Germany, France, and Continental Europe generally, the duties of the inspector-general's department are carried out by the general staff of the army, or of a territorial district. See ARMY ORGANIZATION.

INSPECTORSHIP DEED. In English law, a deed executed between an insolvent person and his creditors, whereby they accept a part payment, and allow the insolvent debtor to carry on the business under their supervision, with a view to further payments. It derives its name from the fact that certain of the creditors named in the deed, as inspectors, assume the duty of supervising and controlling the subsequent management of the business by the debtor. The practice is not common in the United States. See INSOLVENCY.

INSPIRATION (Lat. *inspiratio*, from *inspirare*, to inspire, from *in*, in + *spirare*, to breathe). A theological term used to denote the divine action upon men by which the Bible has been produced. In its most general use, it designates the whole of this process; but often a distinction is made between revelation and inspiration, according to which *revelation* denotes that divine activity by which the knowledge of the truth is supernaturally and personally conveyed to the minds of chosen men, and *inspiration* that divine assistance by which the same men are qualified to write the existing Bible. Employed in the latter sense, the inspiration of the Scriptures signifies a supernatural qualification or special divine authority in the books of Scripture as depositories of truth. When the theologian asserts any book of the Bible to be inspired, he means that it possesses an authority different from any other book, that it contains truth not merely as any ordinary book may do, but by a special divine impress. All orthodox theologians may be said to agree in ascribing this special divine character to Holy Scripture; but further there is no agreement. The mode of inspiration, the degree and extent of it, are all subjects of dispute.

The Roman Catholic Church, whose position in regard to this question is attracting more and more attention as modern criticism deals more radically with theories once firmly held, differentiates between the fact and the method of inspiration. While maintaining the former unchangeably, she has never imposed upon her members any theory as to the latter. She has never felt obliged to do so, since the Bible has never been considered the exclusive source of her doctrine. Claiming for herself a perpetual living power which can always concentrate the inspired element, be it never so diffused, she has never declared anything on the subject of the method that is to be held as of faith, no matter how rigidly one theory or another may have been held by individuals at various times.

(1) The theory of *plenary* inspiration is that the whole letter of Scripture is inspired, that the words were immediately dictated by the Holy Spirit, and are literally the words of God, and not of man. The several writers of Scripture were nothing more than the penmen of the Divine Spirit. Those who maintain this theory speak, indeed, of the individuality and diverse characteristics of the writers of the Scriptures, but the differences are not so much in the moral or intellectual individuality of the writers themselves as in the diverse aims and uses with which the Holy Spirit employs them. The words of Scripture are no less the words of God than if He were heard to utter them from heaven. The authority of the Scripture is absolute. The inspired document is throughout faultless, as the sole work of the Divine Spirit, faultless equally in its form and in its essence, in its spirit and its letter. It admits of no gradation; all is equally divine, and therefore equally accurate, whether it relate to some ordinary fact or to some truth

of the supernatural life, whether it treat of a dogma or of the details of a narrative. Those who hold this view do so on the *à priori* ground of necessity; such infallibility is held to be implied in the very idea of a revelation of the divine will; while those passages which seem inconsistent with the facts of science or of history, or with other parts of the Bible itself, admit, it is maintained, of satisfactory explanation. Those theologians, again, who deny the necessity of infallibility, and hold that the inconsistencies referred to never have been and never can be satisfactorily explained away, argue in the following way: First of all, and especially, the question is not one to be settled according to any preconception, but according to the evidence of the facts given in Scripture. The question of inspiration is to be solved not by speculating what the Bible ought to be, but by examining what it actually is. Furthermore, if it be necessary to the preservation of faith to hold that God has not only revealed the truth to man, but that He has deposited that truth in an infallible record, the infallibility of the canon is no less indispensable; for all would be lost if any doubt was allowed to rest upon any portion of the Word of God. But if an infallible text and an infallible canon be necessary, the idea of verbal inspiration cannot stop short of the conclusion of an infallible interpretation; and even such a conclusion does not save it; for an infallible interpretation does not necessarily insure infallible instruction—all may still be lost by the weakness, ignorance, or defect of the recipient mind. It therefore becomes necessary to ask, not what the Bible must or should be, but what it is.

(2) The theory of *dynamic* inspiration is that the writers of the Bible were so filled with the divine power that, while perfectly free in the employment of all their faculties, they were preserved from all error in conveying the truth which the Bible was written to convey, viz. that pertaining to the way of salvation. This theory has numerous forms, and any statement of it will fail to satisfy many who adopt its general conception of inspiration. Its most important form may be summarized in the definition, the inworking power of God preserved the writers of the Bible in writing it from all error in matters of faith and morals. This theory has its origin in the study of the facts, according to the suggestion made at the close of the last head. It is found that the Gospels in their accounts of the same event differ in various points, in much the same way as other purely human accounts of common events differ. Not only is there an entire ignoring of scientific truth, but often statements which are inconsistent with it. The use of the Old Testament in the New is inaccurate, and often violates principles of exegesis which modern scholars would feel compelled to observe. None of these errors, however, affect the main current of the biblical doctrine. They show that men wrote the Bible acting naturally as men act, and, under human limitations, but they do not impair the value of the Bible for its great purpose. There is in it a system of truth, which is incomparably higher than any human system which has ever been prepared. That system is set forth in faultless perfection; and to the securing of that inspiration was directed. Men needed such a book as the Bible. It could not have been prepared, in the perfection with which we find it clothed, written, as it was, by different men in different ages and at long intervals, without the special help of God. This is its inspiration. In consequence of it, by the answering operation of the Spirit in the heart of the believer, the Scripture shines by its own light and is recognized as the Word of God.

(3) A third theory may be called that of the school of Ritschl. It is not very distinctly formulated, but may be said to deny inspiration in the distinctive sense of the word, and lay all the emphasis upon revelation. We must maintain the supernatural communication of divine knowledge to men, it is said, but after they have got this knowledge, they are left to communicate it according to their natural abilities, and the books they write are committed to the stream of history to be borne where the providence of God may guide them; as all other books are. Thus the human element in the books is large, and no infallibility of any sort, even in matters of faith and morals, is to be affirmed, but the truth of God is there and is conveyed to the minds of men, producing and maintaining a holy people of God in the earth, as by no other book in the world. The evidence for the element of revelation in the Scriptures lies in the actual priority of the Bible in the production of the highest ideas which the mind of man has conceived. No one is more emphatic in maintaining this priority than Ritschl himself. The Christian idea of God was never developed outside of the single circle of Jewish and Christian revelation. The love of God and the basal religious idea of forgiveness, in their Christian forms, were never anticipated by religions or philosophers. Christianity is unique, and therefore divine. But the phenomena of the text of Scripture, the fact that books have been compiled, edited and reëdited, that misconceptions of the course of history have crept in, that biblical books have been lost, and others interpolated, and that cruel and treacherous actions, like the murder of Sisera, are lauded in some parts of the book, effectually dispose of the idea of infallibility, and equally of the idea of any special supervision of the transmission, and hence of the original production, of the biblical books. We have here the effective religious book of the world; it is a supernatural book; but it is not miraculously written or preserved.

(4) By an application of what is called theistic evolution to this subject, in which, however, the categories of materialistic evolution are given a very considerable scope, there has arisen a theory, which has as yet scarcely found articulate expression, but which must be reckoned with, by which not only inspiration, but even revelation is dispensed with. The causes operating in religion are, like all the causes recognized by evolution, immanent. It is not the special enlightenment of chosen minds which we find here, but that enlightenment which comes in the course of all development under the operation of the laws of variation and the operation of environment, and which has given us the steam-engine and other instruments of progressive civilization. Thus the Bible is a purely human book, but it is the greatest of all human books, and should retain its place at the foundation of our religious structure.

Consult: Henderson, *Divine Inspiration* (London, 1852); Hannah, *Divine and Human Ele-*

ments in Holy Scripture, Bampton Lectures for 1863 (London, 1863); Lee, *The Inspiration of Holy Scripture* (London, 1854; 5th ed. 1882); Row, *Inspiration: Its Mode and Extent* (London, 1864); Westcott, "Primitive Doctrine of Inspiration," in his *Introduction to the Study of the Gospels* (London, 1860; 8th ed. 1894); Warrington, *Inspiration* (London, 1867); Delitzsch, *De Inspiratione Scripturæ Sacræ quid Statuerint Patres Apostolici et Apologetæ Secundi Sæculi* (Leipzig, 1872); Rabaud, *Histoire de la doctrine de l'inspiration des Saintes Ecritures* (Paris, 1883); Ladd, *The Doctrine of Sacred Scripture* (2 vols., New York, 1883); Simon, *The Bible an Outgrowth of Theocratic Life* (Edinburgh, 1886); Rohnert, *Die Inspiration der heiligen Schrift und ihre Bestreiter* (Leipzig, 1889); Sanday, *Inspiration* (London, 1893); Schultz, *Old Testament Theology* (Eng. trans., Edinburgh, 1892), gives the Ritschlian theory in application.

INSPIRED IDIOT, The. A name given to Oliver Goldsmith by Horace Walpole.

INSPIRED TINKER, The. A name sometimes applied to John Bunyan.

INSTALLATION (Lat. *installatio*, from *installare*, to install, from *in*, in + *stallum*, place, from OHG. *stal*, Ger. *Stall*, AS. *steall*, Eng. *stall;* connected with Gk. *στέλλειν*, *stellein*, to send, and ultimately with Lat. *stare*, Gk. *ἱστάναι*, *histanai*, Skt. *sthā*, OHG. *stēn*, Ger. *stehen*, to stand). In the Anglican Church, the ceremonial act or process by which a person presented and legally confirmed in a benefice is formally put into possession of his office, and by which he is fully empowered not alone to exercise its functions, but to enjoy its honors and emoluments. The ceremonial form, as well as the name, differs according to the office which is conferred, as 'enthronization' for a bishop, 'induction' for a rector, etc. 'Installation' properly regards the office of a canon or prebendary. (See Induction.) In the non-episcopal churches installation is used for the ceremony by which a pastor is formally introduced to his charge.

INSTANCE, Court of. The branch of the English Court of Admiralty which exercised all the jurisdiction of that court in matters triable under the municipal law (q.v.). This excluded only one class of cases arising under admiralty law—viz. 'prize' cases, which involved international law, and for the trial of which the court required a special commission authorizing it to act as a 'prize court.' The entire jurisdiction of the Admiralty Court was transferred to the High Court of Justice by the Judicature Act (q.v.) in 1873. The above distinction in the exercise of jurisdiction has never prevailed in the United States. However, the term is still employed in England and the United States to describe the kind of jurisdiction exercised in cases involving exclusively the municipal law. See Admiralty; Maritime Law; Prize Courts.

IN′STAURA′TIO MAGNA (Lat., Great Renewing). A great work on the reorganization of the sciences, by Francis Bacon (q.v.). Almost all his philosophical writings actually form part of this vast scheme, or were intended to be included in it.

INSTERBURG, ĭn′stẽr-bo͞ork. A town of Prussia, in the Province of East Prussia, situated on the left bank of the Angerapp, about 60 miles east of Königsberg. It has a castle, a gymnasium, and a seminary for female teachers (Map: Prussia, J 1). Linen-cloth weaving, tanning, brewing, and distilling are the chief industries. Insterburg had its origin in a castle of the Teutonic Knights built in the fourteenth century. Population, in 1890, 22,227; in 1900, 27,287.

INSTINCT (Lat. *instinctus*, impulse, from *instinguere*, to impel, from *in*, in + **stinguere*, to prick; connected with Goth. *stiggan*, AS. *stingan*, to push). The sum of inherited reflex acts, becoming habitual and arising from blended reflex and subconscious though involuntary acts, performed at birth or through life blindly, without practice or previous experience, effort, training, or thought. Instincts in animals are directly connected with the quest for food or with reproduction, especially care for the young, as in egg-laying and nesting.

An instinctive act is any habitual and hereditary reflex action frequently repeated throughout the life, not only of the individual, but of the species, in response to an external stimulus, in part controlled by rudimentary consciousness, but without volition, and always performed with reference to the needs of the animal and the maintenance and preservation of the species.

The instincts of each species or genus of animals are correlated with or dependent upon their peculiar structure and degree of specialization.

Habits are in general confined to the life of the individual, and may or may not be transmitted; but instincts are accumulated reflexes becoming by repetition habits which are manifested and handed down for multitudes of generations.

Instinct is of all stages of development, from (1) merely simple, reflex acts, as those of protozoans, sponges, and polyps, to (2) the highly specialized and complicated acts of the ants and social wasps and bees, as well as birds and mammals. Instincts grow in complexity, and are controlled or blended with or accompanied by more purely conscious and intellectual manifestations as we rise higher and higher in the animal scale, and as the nervous and muscular systems become more and more specialized. The instincts of most birds and mammals, and mostly those of the domestic animals, which have associated with and been taught by man, exhibit the germs of intelligence, and even at times of reason, in its present restricted sense given it by Morgan.

The elements or factors out of which instincts arise are: (1) Needs or the necessities of existence; (2) the stimulus of the physical agents of heat, light, etc., or the physiological stimuli of hunger or of the reproductive functions; (3) reflex acts at first more or less experimental or tentative; (4) the repetition and natural selection of such acts, until they become (5) habits; (6) the perpetuation of such acts by inheritance; (7) the reflex acts and habits becoming blended with rudimentary consciousness (associative memory), without willing.

Instinctive acts are not rarely variable; they are sometimes at fault; they may be modified by change of circumstances, or, through disuse or changed habits and structures, entirely lapse. Thus, in aquatic animals, such as the seals, whales, etc., which have evidently descended from some unknown terrestrial ancestors, entirely new instincts arose as the result of a changed environment. The instincts of young animals may be replaced by a new set. Examples are those of animals which pass through a metamorphosis, as in the case of the caterpillar and butterfly, in which there are two sets or classes of instincts; i.e. (1) those by which the larva is enabled to live, and (2) the reproductive and egg-laying instincts of the butterfly. Thus, the same individual is born with a crop of innate congenital instincts, sheds them with its larval skin, so to speak, and then with the new birth of the butterfly appears a series of automatic and reflex habits and instincts which have arisen in response to the origin of the new structures, such as wings, sense organs, reproductive glands, genital armature, and the elaborate spiral tongue adapted for taking an entirely different kind of diet from that of the grossly feeding caterpillar.

Nothing more plainly proves that instincts are not directly implanted by the direct interposition of a supernatural power, as is still insisted on by Fabre and Wasmann, than that they are special innate or natural propensities, "transcending the general intelligence or experience of the creature," and arising from and dependent on peculiarities of structure and habits. Instincts are 'innate' and 'natural' because they have arisen by a natural growth and have been acquired. The 'sagacity' of the ant, of the wasp, and of the bee is very wonderful; but still more so when we realize the fact that it has evolved in response to the needs of the complicated organism of which it is the natural psychical outcome.

The instinct of the most sagacious ant, bee, or bird may be, and is, occasionally at fault; birds may in certain cases change their nesting habits. On the other hand, certain spiders, insects, as well as birds and mammals, are known to 'rise with the occasion' to overcome obstacles, and to be guided, as we say, by the germs of reason to act much as a human being would under similar circumstances.

There are three grades of mentality; i.e. three steps in the evolution of mind. These are: (1) Reflex acts and tropisms; (2) instinctive acts; and (3) acts of reason. It is, as everybody knows, difficult to draw the line of division between these grades. It may be said, however, that what we call instincts are on the whole intermediate between the simplest physiological or primary reflex acts, especially those resulting from some external stimulus of light, heat, gravity, odors, and sounds; i.e. the various tropisms (see TROPISM), and acts of intelligence and of reason. In short, animals are neither automata, nor are they as a rule guided by intelligence or reason, as in man.

Let us first consider what are mere physiological or reflex acts; i.e. tropisms. One example is the efforts of the young chick at pecking food. This is said by Lloyd Morgan to be "a motor response to a certain stimulus," which is purely mechanical or organic, and is unaccompanied by consciousness. Loeb defines a reflex as "a reaction which is caused by an external stimulus." It is well known that plants, and also the lowest or simplest animals, turn to the light, are heliotropic; that they also respond to the stimulus of cold, heat, hunger, and reproductive needs. They are also geotropic. They move in certain directions, take in food as if exercising the power of choice, though this is not the case. Thus the reflex acts which lie at the base of instinctive acts are, says Loeb, the various tropisms. In this respect the lowest animals (protozoans, sponges, and polyps) are scarcely if any higher than plants. In the higher animals, as in man, winking is a reflex act, the closing of the eyelids is a reaction caused by an external stimulus, as when the conjunctiva is touched by a foreign body, or when the pupil is narrowed under the influence of light (Loeb).

The result of experiments on the reactions of plants and animals to various external stimuli shows that irritability and conductibility "are the only qualities essential to reflexes," and it will be remembered that these are the common qualities of the protoplasm both of plants and animals. "The irritable structures at the surface of the body and the arrangement of the muscles determine the character of the reflex acts" (Loeb).

Reflex acts apparently have a purposive character. Examples of reflex acts in the whole animal, the individual (not simply in distinct organs), are those actions related to the outer world and other organisms, manifested by protozoans, such as monads and amœbæ, by sponges and polyps, as well as the ascidians. Their movements, modes of escaping danger, of getting food, or their deportment in freely moving forms in the presence of their prey or their enemies, their mode of conjugation, are acts in response either to external stimuli, such as light, heat or cold, odors, tastes, smells, or the effects of hunger or the reproductive functions.

THE NATURE OF INSTINCT. What has been said prepares the way for an attempt at an explanation of the nature of instinct. It is evident that this can only be understood after more thorough experiments and extended observations, both on reflex and instinctive acts, than have yet been made. It is certainly difficult to draw a sharp line of demarcation between reflexes and instincts. As the result of recent experiments, Loeb regards instincts as inherited reflexes so purposeful and so complicated in character that nothing short of intelligence and experience could have produced them. These reflex acts, becoming habitual and persisting through individual life, or at least a portion of it, result in what we call habits.

What are called instinctive acts are manifested by animals 'higher' or more specialized than those above mentioned. We see them exhibited in the higher worms (annelids), the land-snails, and squid, perhaps the starfish and sea-urchin, etc., though these forms are on the border line. The crustacea, spiders, and insects are guided by instinct, with here and there germs of intelligence, until we come to birds and mammals, which in some cases at least approach man in the capability of meeting or adapting themselves, as if by intention, to emergencies or to some end, this being an incipient form of reason.

DEFINITIONS OF INSTINCT. Herbert Spencer defines instinct as compound reflex action, and on another occasion as "a kind of organized memory." He argues that instinctive actions grow out of reflex, and in time pass into intelligent actions (Romanes). Samuel Butler also asserts that instinct is 'inherited memory.' J. J. Murphy remarks that "reason differs from instinct only in being conscious. Instinct is unconscious reason, and reason is conscious instinct." Romanes defines instinct as "reflex action into which there is imported the element of consciousness." Packard, from Murphy's suggestion, infers that "instinct is the sum of inherited habits."

Lloyd Morgan says of instinct: "It is a bit of animal automatism not necessarily involving more than the lower brain centres;" but, he adds, it is a bit of automatism accompanied by consciousness in a broad sense. The rôle of consciousness in pecking is to select the adequate responses, and to steady the muscular mechanism to its work.

'Automatic' responses are *variable;* the freshly hatched chicks at first in pecking make bad shots as well as occasional good ones.

EXAMPLES OF INSTINCTIVE ACTS. In chicks: Pecking, walking, scratching themselves, preening their down and feathers, stretching up and flapping their wings, scratching the earth, squatting down and dusting themselves, scattering and crouching when alarmed, making the danger churr and other sounds.

In ducks: The way they seize and mumble their food in the bill, their swimming, piping, smoothing the down of the breast with their bills, etc. Alligators on hatching rush with open jaws at anything presented to them, and bite it.

In the higher animals, as birds and mammals, it is more difficult to separate instinctive from intelligent acts. The migrations of birds, and perhaps of fishes, are variable, and Darwin says that this instinct "is occasionally lost." It should be observed that the migrations of birds, as of other animals, locusts, the reindeer, lemming, etc., are primarily reflex in their nature, being initiated by cold or the lack of food.

Typical examples of the most striking and inexplicable instincts are the nesting habits of spiders, of the social insects, such as ants, wasps, and bees, those of birds, also of the muskrat and beaver, the mode practiced by worker bees arranged in files of ventilating by a peculiar movement of their wings, the well-closed hive, and the building of cells of the honeycomb by the hive-bee.

Our present knowledge of the two chief groups of instincts may roughly and provisionally be classified thus:

(1) *Reflex acts mingled with associative memory (consciousness or intelligence):*

Mammals.
Birds.
Reptiles.
Amphibia (tree-frog).
Fishes (certain bony fishes).
Insects (especially the social species).
Crustacea (certain lobsters and crabs).
Spiders.
Cephalopod mollusks.
Snails (Helix).

(2) *Reflex acts only:*

Scorpion.
King-crab.
Sharks and flounders.
Ascidians.
Mollusks, bivalves (pelecypods), and many univalves (gastropods).
Echinoderms.
Worms (including annelids).
Cœlenterates, polyps, and actinians.
Sponges.
Protozoa (amœbæ, monads, and infusorians).

The highest form of instincts are those of care for the young, or the eggs and nest, as shown by ants, certain fishes, and especially by birds and mammals.

COMPLEX INSTINCTS. A complex instinct like that exhibited by the higher animals is generally regarded as the mingling of consciousness, or, as Loeb and also Bethe would call it, associative memory, with reflex acts. The test is the animal's capacity for learning or for being "trained to react in a desired way upon certain stimuli" or signs. It is seen in dogs, in the instincts of animals used in hunting, and in birds. In the lower vertebrates, memory is manifested. "Tree-frogs, for example, can be trained, upon hearing a sound, to go to a certain place for food," while other frogs, as the European *Rana esculenta*, exhibit no such capacity. Some fishes possess memory, while its existence in sharks and in the flounder is doubtful.

Loeb protests against what he calls the anthropomorphism of Romanes, Eimer, Preyer, and others; yet he opposes the conclusions of Bethe, who denies that bees and ants possess associative memory, though Loeb himself thinks that they have little intelligence. The possibility of associative memory Loeb concedes in favor of spiders, certain crustacea, and cephalopod mollusks.

Complex instincts, often so mingled with incipient acts of intelligence as to astonish the observer, have repeatedly been noticed in the ants. They have the power of communicating with one another, and they are said to be susceptible of education.

More exact and critical views bearing on the origin of instincts have been expressed by Loeb, whose recent experiments and suggestions are noteworthy.

Passing on to the subject of the greater complication of instinctive actions compared with those which are simple and reflex, "we have," he says, "to deal with a chain of reflexes in which the first reflex becomes at the same time the cause which calls forth the second reflex." This is illustrated by the taking of food, of a fly, by the frog. Another example is the wonderful and hitherto inexplicable egg-laying habits of insects. Loeb explains that as meat-maggots are positively chemotropic (see TROPISM) toward decaying meat—i.e. are directed in their movements or "oriented by certain substances which radiate from a centre," just as in the movements of heliotropic animals toward the light—so the female flesh-fly "possesses the same positive chemotropism for these substances as the larvæ, and is accordingly led to the meat. As soon as the fly is seated on the meat, chemical stimuli seem to throw into activity the muscles of the sexual organs, and the eggs are deposited on the meat. It may also be possible that at the time when the fly is ready to deposit its eggs the positive chemotropism is especially strongly developed. It is only certain that neither experience nor volition plays any part in these processes." This explanation may also be extended to all other insects, whether ovipositing on animal matter or on the leaves of this or that plant, or, as in the case of ichneumon or other parasitic flies, upon or within the body of its accustomed host.

Loeb recognizes the difficulty of analyzing the more complex instincts. The periodic depth migration of marine pelagic animals is, he says, a simple case of instinctive migrations, while the migrations of birds or the return flight of the carrier pigeon seem to be complicated by memory. "It seems to be certain that the carrier pigeon finds its way back by its visual memory of the locality from which it started," and he adds that this is true of wasps, bees, and possibly of ants.

THEORIES OF THE ORIGIN OF INSTINCT. Descartes denied to animals the power of reason, regarding them as automata, and held that instincts were implanted in them by the Creator; and this view is still held by Fabre and Wasmann, both distinguished as observers of the instincts of insects. That instincts are variable and are sometimes at fault was affirmed by Reimarus (1773). He says: "Many mechanical instincts are practiced from birth without experience, instruction, or example, and yet faultlessly. They are thus seen to be certainly inborn and inherited." See INSECT.

The first thinker to point out the evolutionary origin of instinct was Lamarck, whose view, briefly stated, is that instincts are the sum of inherited habits.

Darwin's view is that instincts were "slowly acquired through natural selection."

DO ANIMALS POSSESS INTELLIGENCE, AND DO THEY REASON? In view of what has been said by physiologists and experimenters, it results that we must proceed cautiously, and not anthropomorphize as regards the reasoning powers of the higher animals, and, even if we are compelled to give up cherished opinions as to the intelligence and so-called reasoning powers attributed to animals, suspend our judgment and wait for the results of further observation and experiment. Meanwhile the reader may adopt the views of so careful and well-trained a student of animal behavior as Lloyd Morgan. In observing that the chick under his observation rapidly profited by experience, after a few practical trials, he concludes that intelligence is founded on experience. One important test of intelligence is the power of making a choice, and this appears to be the basis of intelligent adaptation to circumstances. Intelligence involves the association of impressions and ideas, and it implies a power of control over the motor responses. (Introduction to *Comparative Psychology*, p. 215.)

In his last work on the sensations of insects Forel claims that instincts depend on sense-perception. An ant which had suffered deantennization abandoned and neglected its pupa. Instinct, he says, does not constitute all the mentality of an ant. He attributes to them a mind. Besides instincts, he sees in them 'small plastic judgments;' they display in their actions new combinations which differ from their usual automatism, aiding them to overcome difficulties, to make a choice between two alternatives. He remarks that the faculty of direction in bees, their astonishing memory for places, proves how far mere instinct and automatism are from constituting all the mental life of insects. He thus opposes the new German school, who, with Bethe, would, he says, suppress all psychology, all 'anthropocentrism,' in studies on the behavior of animals.

Young animals are taught by their parents, and what appears to be instinct is the result of early education. We know that young birds are taught to fly, that foxes and other beasts of prey teach their young to hunt, how to escape from their enemies, or to fear them. We know that young animals are more easily trapped than the older and more experienced ones. All this is a proof of an inborn capability of learning by example and by experience; and this carries us back to Erasmus Darwin's idea that instincts are based on imitation.

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INSTITUTE (Lat. *institutum*, regulation, ordinance, from *instituere*, to set up, from *in*, in + *statuere*, to establish, from *stare*, to stand). In the land law of Scotland, the person who is designated in the instrument creating an entail (q.v.), and so 'instituted' as the tenant of the entailed estate. The persons in whom the estate thereafter becomes vested by descent are described as substitutes. See ESTATE; FEE TAIL.

INSTITUTE OF FRANCE. The official name for a group of learned societies in France organized at different times, but having for their object the fostering of some special branch in literature, art, the sciences, or philosophy. At present the Institute comprises five distinct bodies known as (1) Académie Française; (2) Académie des Inscriptions et Belles-Lettres; (3) Académie des Sciences; (4) Académie des Beaux-Arts; (5) Académie des Sciences Morales et Politiques. The first three academies, dating as separate institutions from the seventeenth century, were abolished by the Convention on August 8, 1793. Two years later, under the title of Institut National des Sciences et des Arts, there was established by the Directory an association for the promotion of arts and sciences, which was divided into the three following classes: (1) Physical sciences and mathematics; (2) moral and political sciences; (3) literature and fine arts. In 1803 Napoleon I. reorganized the body, dividing it into four classes—mathematical and natural sciences, French language and literature, classical languages and literatures, and fine arts—and giving it subsequently the name of Imperial Institute of France. After the Restoration it was again reorganized (1816) into four academies, comprising the first four bodies enumerated above, to which was added in 1832 the fifth academy, the name of the whole being changed at the same time to Institut de France.

Each academy in the Institute has its independent government, and the free disposition of the funds allotted to it, while an agency and secretaries, the library, and the valuable collections of the Institute are common to the five. The general fund is managed by a committee of ten members, two from each academy, under the presidency of the Minister of Public Instruction. The members, of whom there are in addition to the regular members, honorary members, corresponding members, and foreign associates, are all elected by ballot, and the election is confirmed by the public authorities. Each member receives an annual salary of 1500 francs, and the perpetual secretaries are given 6000 francs. An annual meeting is held on October 25th, when public announcements are made of the award of important prizes.

(1) The Académie Française was founded by Cardinal Richelieu in 1635. It had its origin in a small group of literary men, who, as early as 1630, were accustomed to meet at each other's homes for the purpose of exchanging their views on various topics in literature, art, and science. Richelieu, on becoming aware of the existence of this informal society, offered them the royal protection if they would hold their meetings in public, and the society was thereupon constituted as the Académie Française (1635). The special function assigned to the organization was the improvement and conservation of the French language. For this purpose work was begun on a dictionary of the French language, which, however, did not see the light till 1694. Within two years from the date of its formal authorization, the membership of the academy had risen to forty, at which number it has since remained. From 1793 to 1816 the Académie Française, as such, did not exist (see above). The original purpose of the academy has not been forgotten; at the present day its chief business is still the revision of the *Dictionnaire de l'Académie Française* (1st ed. 1694; 7th ed. 1878); but as a matter of fact in the intellectual world of France the French Academy holds a much higher rank than that of a mere lexicographical bureau. From an early date admission to the French Academy was sought as an honor, and for more than a century an election to a seat among the forty 'immortals' has been considered as the crowning glory to a successful literary career. Nevertheless the Academy has laid itself open to reproach for a certain narrowness of spirit in shutting its doors on some of the greatest men in the history of French literature. Among these 'occupants of the forty-first chair,' as they have been called, were Descartes, Pascal, Molière, Jean Jacques Rousseau, Diderot, Dumas père, Balzac, Alphonse Daudet, and Emile Zola. Among the more important prizes which this academy has at its disposal is one of 2000 francs, awarded to the best poem or essay on a given subject; the Montyon prize of 22,463 francs, given as a reward for the most heroic deed done by a native of France; and one of 21,940 francs, given to a native of France who has written and published a work having the most valuable application to the arts; the Gobert prize, for the most important work on the history of France, as well as a large number of other prizes, designated as *prix littéraires* and *prix de vertu*. Its annual public meeting is held in November.

(2) The Académie des Inscriptions et Belles-Lettres was founded in 1663, by Colbert, and has 40 ordinary, 10 honorary, and 50 corresponding members, and 8 foreign associates. It has for its principal objects the study of medals, inscriptions, monuments, antiquities, and ancient and Oriental languages. It has various prizes at its disposal, and publishes *Mémoires*. Its annual public meeting is held in November.

(3) The Académie des Sciences was founded in 1666, by Colbert, and has 66 ordinary, 10 honorary, and 100 corresponding members, and 8 foreign associates. Its prizes include an annual sum of 3000 francs, given alternately, for the best discussion of a subject in mathematics and physics; the Montyon prizes, six in number, having an annual value of 44,845 francs; the Laland prize, given annually, for astronomical work; and several others. This Academy publishes *Mémoires*. Its annual public meeting is held in December.

(4) The Académie des Beaux-Arts was founded by Mazarin in 1648, and the subjects of painting and sculpture, music, and architecture were added respectively in 1664, 1666, and 1671. It has 40 ordinary, 10 honorary, 10 foreign associates, and 61 corresponding members. Besides the prizes in painting, sculpture, architecture, engraving, and music, awarded to the pupils of the Ecole des Beaux-Arts and the Conservatoire de Musique, it has under its charge the publication of the *Dictionnaire général des beaux-arts*. It also conducts the examination for the Prix de Rome in the various arts. Its annual public meeting is held in October.

(5) The Académie des Sciences Morales et Politiques was restored in 1832, after having been suppressed in 1803, and has 40 ordinary, 10 honorary, and 45 corresponding members, and 6 foreign associates; it is divided into five sections, and has for its chief purpose the discussion of mental philosophy, law and jurisprudence, political economy and statistics, general and philosophical history, and politics, administration, and finance. It has the Baujour, Faucher, Halphen, Bordin, and other prizes at its distribution. It publishes *Mémoires*, and its annual public meeting is held in December.

The academies forming the Institute of France meet regularly in the Mazarin Palace, which is on the left bank of the Seine, opposite the Louvre, and their meetings are attended with much ceremony. Consult De Franqueville, *Le premier siècle de l'Institut de France* (2 vols., Paris, 1895).

INSTITUTIONAL CHURCH, The. A cross-sectional split among the 150 sects in the United States has developed ritualistic and institutional tendencies in the churches. The ritualistic churches lay emphasis upon the efficacy of certain beliefs, forms, sacraments, and a limitation of functions, and appeal to the economically superior classes. The Institutional Church, on the other hand, demands activity, apparent results, the amelioration of the outward as well as of the inward life of its members; it reaches out for the reclaimables in the social-debtor class, and it is identified with social rather than distinctly religious movements. The name 'Institutional Church' was first used by President Tucker, of Dartmouth College, and applied to Berkeley

Temple, Boston. Since this name magnifies the departmental organization and has a mechanical sound, 'Free Church' and 'Open Church' are other names proposed; but as the former designation is applied to a church with free pews, Open Church has met with the most favor. Ever since 1840 some of the English churches have been taking on new functions, but the new church movement in the United States dates back hardly to 1880, and as a recognized movement it is scarcely older than 1890. It had its origin in the same impulses which created the University Settlement, Christian Socialism, and the Salvation Army—a feeling that the churches were not reaching the masses, and that each community had much work to be accomplished which could be done by the Church. The object is distinctly humanitarian. The Institutional Church becomes the centre and inspiration of the daily lives of its members, to whom it ministers according to their immediate needs, and has, as a result, reabsorbed certain functions (educational, medical, charitable) which had been assumed by the State and other organizations since the Roman Catholic Church ceased to be the universal Church.

The characteristics of the Institutional Church are, in general, an adoption of secular methods. The platform of the Institutional Church League states that it "stands for open church doors for every day and all the day, free seats, a plurality of Christian workers, the personal activity of all Church members, and a ministry to all the community through educational, reformatory, and philanthropic channels." The organization of such churches is very complete. The numerous committees have definite duties, such as welcoming strangers, house to house canvassing, visiting members, and superintending work of different kinds. The finances are placed in competent hands and managed upon business principles. The ushers for church services are carefully chosen. Subpastors, deaconesses, sisters, and nurses carry on certain features of the work. The distinctly religious work consists of attractive services; music, frequently by large choirs or choruses; well-organized Sunday schools; pleasant Sunday afternoons; prayer meetings with special features; open-air meetings in summer; and the encouragement of helpful associations, such as men's Sunday evening meetings, the brotherhoods of Saint Andrew and of Andrew and Philip, and Christian Endeavor societies. The secular work aims at educational, social, and physical improvement. Some churches have established special schools and colleges, which give an opportunity to obtain or to supplement a rudimentary education; industrial classes are maintained; lectures, illustrated and university extension, are given; literary and debating clubs are encouraged; and libraries, reading-rooms, and recreation-rooms, with billiards, bowling-alleys, and games, are provided. The physical man is ministered to in gymnasiums, swimming-pools, military drills, and athletic teams. The philanthropic work includes employment bureaus, aid to worthy poor, wood-yards, dispensaries, hospitals, crèches, penny provident funds, and personal efforts to reach the vicious or intemperate. When funds are sufficient, special buildings have been constructed.

The denominations especially engaged in this work are the Episcopal, Congregational, and Baptist, although there are a number of Presbyterian, Roman Catholic, Unitarian, and Methodist churches which make use of the same methods. Some of the prominent Institutional churches are: Berkeley Temple, Ruggles Street Baptist, and Parker Memorial, of Boston; Fourth Congregational Church, of Hartford; Saint George, Saint Paul's, Saint Bartholomew, and Judson Memorial, of New York; Tabernacle, or People's Palace, of Jersey City; Grace Church (The Temple) and Bethany Church, of Philadelphia; Pilgrim Church, of Cleveland; Ninth Street Church, of Cincinnati; Plymouth Tabernacle, Institute, and People's College, of Detroit; People's Church, of Saint Paul; the Tabernacle, of Denver; and, one of the oldest of all, Plymouth Church, of Indianapolis.

The Open and Institutional Church League was organized in New York in 1894. The league has given aid and counsel by correspondence; it published for three years a magazine, the *Open Church;* and it has held conventions in Boston (1895), in Philadelphia (1896), in Brooklyn (1897), in Hartford (1898), in Worcester (1899), and in New York (1901). At present the League is doing little active work; but its secretary, in connection with the Federation of Churches in New York, has organized the *National Federation of Churches and Christian Workers.* The principles of the League have taken a strong hold on Church life, and many churches are adopting free pews and institutional methods.

Important results claimed for these methods are increased church attendance, especially of men; a higher spiritual tone, and the arousing of activity, which is considered by sociologists as an essential moral and industrial stimulant. In all these churches the business clergyman with executive ability is brought into prominence. The objections made to this movement are: Its expensiveness; the heavy burden placed upon the minister; the tendency to overlook the spiritual; and the secularization of the Church. It may be said that the Church to-day is dependent entirely upon voluntary association. There are no religious restraints other than those of inherited habits, which are easily modified by the environment. If the Church, with its power and organization, does not attempt to offer temporarily a remedy for serious social evils, it will lose its slight hold upon the unfortunate classes. Undoubtedly the success of individual churches is dependent upon the character of the minister or some dominant personality, whose death cripples the work. Specialization in Church work among the clergy may obviate this difficulty. Since the people reached are from the lower middle class, constituting an indifferent element in the community, it is probable that elements of the population are brought within Church influence who would otherwise have remained outside. The social benefits are important in that they emphasize individual responsibility, and by making outsiders members of special groups impress them with a sense of relationship to the whole community.

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INSTITUTO HISTORICO E GEOGRAPHICO BRAZILEIRO, ên′stê-tōō′tô ê-stō′rê-kô ā jā′ô-grä′fê-kô brä′zê-lyā′rô (Port., Brazilian Historical and Geographical Institute). A society founded at Rio de Janeiro in 1839. Its organ, the *Revista Trimensal,* is devoted to the publication of historical and geographical documents.

INSTRUMENT (Lat. *instrumentum,* tool, from *instruere,* to construct, from *in,* in + *struere,* to build). A term of law to describe any formal written or printed document by which legal rights are created. Thus a deed of conveyance, a last will and testament, a memorandum of agreement, a promissory note, a bill of lading, a bond, a mortgage, are all legal instruments; but the term is not properly applicable to an entry in a book of account, or to a memorandum made for the sake of evidence or for perpetuating testimony.

INSTRUMENTAL MUSIC. A term applied to music performed exclusively on instruments, as distinguished from that performed by voices, or even voices with instrumental accompaniment. Even in ancient Greece purely instrumental music was known. In the sixth century B.C. Sacadas of Argos is said to have performed publicly on the *aulos* (flute) at the Pythian Games. In the same century Agelaus of Tegea won great distinction as a performer on the *kithara.* But instrumental music as performed by a number of instruments was unknown. The Greek orchestra served only to accompany the voices. Harmony being unknown to the Greeks, such accompaniment was nothing more than a performance of the vocal part in unison or octaves upon the instruments. With the use of stringed instruments played by a bow a new phase of instrumental music began. The *fiddle* was brought over from the Orient, and soon became the instrument upon which the troubadours accompanied their songs. It was also adopted by the wandering fiddlers (*fahrende Spielleute*) of the Middle Ages. The oldest compositions written expressly for instrumental performance were dances. But the style of these is entirely vocal. It is during the sixteenth century that the first traces of an individual instrumental style are perceptible. It was the keyed instruments which contributed to a differentiation between the vocal and instrumental styles. As they were unable to produce sustained tones or chords, composers soon discovered that broken chords and figuration were better adapted to these instruments. Even in compositions for the organ this principle was adopted; and before long the new style of figuration, and rapid note progression, were also adopted for orchestral instruments. Three instruments have become prominent in the development of the instrumental forms, viz. the organ, violin, and pianoforte. The great organists took from the vocal style the fugue. The instrumental fugue reached its growth in the masterpieces of J. S. Bach, which to this day still are unrivaled. The violin and pianoforte developed the sonata form, which is regarded as the highest of all instrumental forms. The cyclical forms can be traced to two main sources, viz. the old dances and the Florentine musical drama. By uniting a number of dances (all in the same key) the *suite* originated. The older operas were opened by an instrumental prelude which originally was nothing more than a madrigal arranged for instruments. But soon a special instrumental composition took its place. The form of this *sinfonia,* as it was called, was taken from the aria, i.e. it had three parts, A, B, A, of which the third was a repetition of the first. Gradually the three parts were detached and appeared as separate movements. Composers paid special attention to the first movement, from which gradually the sonata form was evolved. A sonata was originally any instrumental work (chiefly performed on a keyed instrument with strings) as opposed to a vocal one. Then 'sonata' was applied to a cyclical composition for piano. The great sonatists of the eighteenth century (though composing for the violin) retained the name. The form was finally established by Haydn and filled with the loftiest contents by the genius of Beethoven. The symphony is nothing else than a sonata of large dimensions for orchestra. Trios, quartets, concerts, etc., are all sonatas for a particular group of instruments. Instrumental music to-day is divided into absolute and programme music. The former kind is music written for its own sake; the latter attempts to portray definite ideas according to a given programme. See CYCLICAL FORMS; OVERTURE; PROGRAMME MUSIC; SONATA; SUITE; SYMPHONY.

INSTRUMENTATION, or ORCHESTRATION. The art of arranging the parts of an orchestral composition for the various instruments. Although from the beginning of the sixteenth century composers wrote for various combinations of instruments, instrumentation has become a real art only quite recently. The Gabrielis, for instance, employed violins in their instrumental works, but had no idea of the true character of this instrument. They used it only, like the trombones, for sustained notes. Even the instrumentation of Bach and Handel is very primitive. Gluck seems to have been the first to use the various instruments with a conscious purpose and a knowledge of their peculiar character. Haydn and Mozart made scarcely any advance in instrumentation over Gluck. In the works of Beethoven we find for the first time each instrument speaking its own language, and with him the *art* of instrumentation may be said to begin. Weber accomplished for the opera orchestra what Beethoven had done for the symphony orchestra. In the works of Wagner and Berlioz instrumentation reached its culmination. Just as there is a special style of writing for the pianoforte (Klaviersatz) so there is also one for the orchestra (Orchestersatz). It is not sufficient for a composer to know thoroughly the compass and peculiarities of each instrument. Effective instrumentation requires also the proper distribution of the separate tones of a chord among the various instruments. Thus, if a composer should write the C major chord for trombones in successive thirds, *c, e, g,* the effect would be a confused mass of sound; whereas the proper effect would be obtained by writing *c, g, e′.* The science of instrumentation teaches the pupil the compass and peculiarities of the different instruments, as well as their combinations. But talent for instrumentation and orchestral writing is independent of purely creative talent, although as a rule the two are combined. Chopin, however, is an example of a great composer who was almost destitute of any talent for instrumentation; whereas Wagner, the consummate master of orchestral writing, wrote a very amateurish pianoforte style. The best works on instrumentation are those of Marx, Lobe, Prout, and especially Berlioz and Gevaert. See Orchestra; Score.

INSTRUMENT OF GOVERNMENT, The. A written constitution for the Protectorate in England, set forth on December 16, 1653. Since January 15, 1649, the 'Agreement of the People' (q.v.) had been nominally in force, its provisions being only partially carried out, but there was urgent need of some effective guaranty of civil liberty. The instrument provides for a constitutional government, administered by a Lord Protector, and a Parliament of a single house. An elective assembly is to be summoned on the 3d of September, 1654, and thereafter once in every third year. The distribution of county and borough seats in England and Wales is based on the schedule provided in the Agreement of the People, although there are important changes. For the first time provision was made for a Parliamentary union of England, Ireland, and Scotland. With the exception of those who had engaged in the war against the Parliament since 1641, or in the Irish rebellion, or professed Roman Catholicism, the franchise and the right of being elected are conferred upon "persons of known integrity, fearing God, and of good conscience, and being of the age of twenty-one years," if seized or possessed of real or personal estate to the value of £200. There is no provision for the borough franchise, that being left apparently to the existing custom of each place.

The extended powers of the Protector in foreign, military, and civil affairs are limited by the Parliament and the Council of State. A council of fifteen members is appointed in the instrument itself. Other members may be added by the Lord Protector and the Council; but the number may never be more than twenty-one nor less than thirteen. By the instrument Oliver Cromwell is created Lord Protector for life. His successors are to be elected by the Council. A veto upon legislation is not granted the Protector. All bills passed by Parliament must be presented to him; and if his consent be not given within twenty days, they become laws, unless they are contrary to the Instrument. There is a responsible Ministry. The "Chancellor, Keeper or Commissioners of the Great Seal, the Treasurer, Admiral, Chief Governor of Ireland and Scotland, and the Chief Justices of both the benches," are to be chosen by the consent of Parliament. All other appointments are apparently left in the Protector's hands. Religious liberty is guaranteed, except to "Popery or Prelacy," and to "such as, under profession of Christ, hold forth and practice licentiousness."

The Instrument of Government reveals the remarkable ability of its framers. The most serious defects are the lack of any provision for amendment and the failure to secure the national sanction. It broke down because the Parliament summoned under its provisions assumed the power of a constituent assembly. It was later amended in the *Petition and Advice* (q.v.). For the text of the Instrument, consult: Gardiner, *Constitutional Documents* (Oxford, 1889); and for discussion, id., *Commonwealth and Protectorate* (New York, 1894-1901); Masson, *Life of Milton*, vol. iv. (London, 1873-94); Jenks, *Constitutional Experiments* (ib., 1891); Inderwick, *Interregnum* (London, 1891).

INSTRUMENTS, Musical. See Musical Instruments.

INSUBRES, In'sû-brēz. A Gallic people who crossed the Alps in the fourth century B.C., and settled in Italy north of the Po. Next to the Boii, they were the most powerful and warlike tribe found in Cisalpine Gaul at the time this region first came in contact with Roman arms. In B.C. 222, shortly before the Second Punic War, the Romans captured their capital, Mediolanum (now Milan), and reduced the tribe to submission, a victory which completed the Roman conquest of all that country lying between the Alps and the Apennines.

INSULATORS. See Electricity; Conductor and Insulator of Electricity.

INSURANCE (OF. *enseurance*, from *enseurer*, to insure, from *en*, in + *seur*, sure, from Lat. *securus*, free from care, from *se-*, without + *cura*, care). Insurance must be differently defined according to the aspect of it which is under consideration. Every person who embarks his capital in any kind of industrial activity is obliged to make accumulations to replace that part of it which is used up in the productive operation. Some of these accumulations are made to meet losses which are certain and definite both in time and in amount. Such accumulations should be large enough to replace the capital used up and no larger. Other accumulations are made to meet losses of a more or less uncertain character. Such accumulations are, for the entire group engaged in any line of industrial activity, larger than the losses, and the excess of accumulation over loss varies directly as the degree of uncertainty. The accumulations of an individual to meet uncertain losses constitute his insurance fund, and so far as he makes such accumulations he may be said to insure himself. From this point of view insurance is the accumulation of funds to meet uncertain losses.

One person whose property is exposed to a risk of some kind may be able to transfer that risk to another person for a consideration. The latter person undertakes to make good to the former any loss which he may suffer from certain specified accidental causes. The person guaranteeing the reimbursement for such accidental loss may be said to insure against the loss. From this point of view insurance is the transfer of an existing risk from the person exposed to it to another person or group of persons.

When one person merely assumes the risk of some other person, there is little or no social gain from the transaction. Whatever accumulation the former would have had to make if he had carried his own risk, the latter must make after he assumes the risk. The burden which the risk imposes on society remains unaffected. If, however, the risks of many individuals are brought together in a group, a new principle is brought into play. The uncertainty as to the amount of loss to be expected steadily diminishes as the number of risks included in the group increases. Thus an insurance company, which has assumed the risks of thousands of individuals, is exposed to much less uncertainty as to the amount of loss it will have to indemnify in a given period of time than any one of the individuals is as to the amount of loss he would suffer during the same period if uninsured. The total amount of loss which the company experiences increases as the number of risks it is carrying increases; but the proportion of the total loss which may be considered as certain steadily increases and the proportion of uncertain loss diminishes. For the company the only uncertainty is as to how much the actual loss will differ from the average loss, and by the well-known law of averages the percentage of variation between actual loss and average loss diminishes as the number of cases increases. Now the insurance company under competitive conditions makes its accumulations under the same conditions as the individual. To meet definite losses it accumulates only the amount of the losses; to meet uncertain losses it accumulates in the long run an amount in excess of the losses, and this excess varies with the degree of uncertainty. It will be seen, therefore, that the company can carry the risks of a hundred thousand individuals on a much smaller accumulation than would be made by the individuals if each were carrying his own risk. This reduction in the cost of carrying risks is one of the economic advantages of commercial insurance.

The second advantage arises from the diffusion of loss. While it is true that for the entire group of persons engaged in a particular industry accumulations to meet uncertain losses will exceed the amount of the losses, it is equally true that some will suffer loss in excess of their accumulations, while others will make the accumulations and escape the loss. In other words, while the group as a whole will make extra gains on account of the existence of risks, these gains will be unequally distributed among the members of the group. Those who suffer the loss will be seriously crippled financially if not actually ruined, while those who escape the loss will reap all the advantage. If, on the other hand, the members of the group are all insured, the system of premiums and indemnities diffuses the losses actually suffered among all the members of the group. This causes such losses to fall on the least important part of the capital of all instead of being concentrated on a few unfortunate individuals. In this way the economic evils caused by the accidental destruction of property are greatly modified. From the social point of view, therefore, insurance may be defined as an economic institution for reducing the accumulation to meet uncertain losses and for lessening the evil consequences of the accidental destruction of property, through the combination of the risks of many individuals in one group. Accumulation to meet uncertain losses and the transfer of risk are both involved, and in addition the combination of many risks in one group. It is this definition of the term that covers the business of insurance as it is carried on in the economic world.

THE RELATION OF THE INDIVIDUAL TO UNCERTAINTY. If we turn now from the social aspects of insurance to consider it from the point of view of the insured person, we find that for him its chief characteristic is the substitution of certainty for uncertainty, of a certain and definite expense for the possibility of an uncertain loss. Every person engaged in any form of industrial activity is exposed to many chances of accidental loss. Some forms of danger may be practically eliminated through the adoption of measures calculated to reduce the possibility of loss. Such measures may be grouped under the name prevention. It is to be noticed that the fact that it is possible to avoid the danger of loss in a particular case by the adoption of preventive measures does not prove that it is desirable to do so. Such measures may cost more than they save. Preventive measures, therefore, will be adopted only so far as they are found to be economically advantageous.

A person engaging in industrial activity finds himself exposed to the possibility of accidental losses from various sources and of various degrees of uncertainty. To protect himself he may adopt any one of three methods. So far as it is economically advantageous, a prudent man will adopt preventive measures which will reduce the danger of loss and so lessen the degree of uncertainty. Against some of the remaining risks he may, from necessity or by choice, protect himself by making accumulations to replace the capital accidentally destroyed. He may then be said to be insuring himself, although the term self-insurance is more commonly restricted to such conduct with regard to risks against which it is possible to purchase protection from the insurance company. Where the transfer of risks to a company is impossible, as in the case of the danger of a shrinkage in the value of a stock of goods through a change in human wants, the method of self-insurance is the only one that can be adopted. Finally, with respect to a limited number of risks, protection may be secured by transferring them to insurance companies, and substituting the obligation to make fixed and definite payments to the company for the necessity of making individual accumulations. The choice between these three methods of preparing to meet uncertain accidental losses will be made by a prudent person on the basis of their relative cost. Where insurance in an established company is possible, the choice of self-insurance would never be justifiable, if the cost of insurance in the company were as low as it could be made with entire safety. It is only because insurance companies fail to reduce premiums to the cost level that many large business concerns find it advantageous to carry their own risks. A large concern with many detached risks can do it where a small concern cannot, but under ideal conditions it would not be a profitable proceeding even for the former.

COMMERCIAL INSURANCE.

Commercial insurance comes under the last of the three definitions given at the head of this article. It is an economic institution for dealing with uncertain losses. The study of it may be conveniently made under three heads: The relation between the insured and the company, including an examination of the nature of the insurance contract; the kinds of insurance companies and their characteristics, including their methods of operation; the relation of the Government to insurance, including a discussion of what it ought to be, as well as what it is.

A. THE RELATION BETWEEN THE INSURED AND THE INSURANCE COMPANY. *The Risk.*—An insurance contract transfers a liability to uncertain loss of a more or less narrowly defined nature from the person insured to the insurance company. For the insured it is the substitution of a definite payment or series of payments for the possibility of an uncertain loss; for the company, conversely, it is the acceptance of an uncertain liability in exchange for a definite payment or series of payments. It may be noted in passing that in the case of the mutual insurance company there is in theory the transfer of only a part of the uncertainty. The insured, being also insurer, is still exposed to some uncertainty as tc the amount of loss he will suffer in the form of assessments. In practice, however, the difference between insurance in a mutual company and in a stock company is very slight, and during the present discussion may be disregarded. (Further reference to this matter will be made in considering the different kinds of insurance companies.) The insurance company assumes the legal obligation of paying to the insured certain specified sums on the occurrence of certain specified events. It assumes these liabilities, however, with the certainty that in the great majority of cases it will not be called upon to make the payments. Its actual liability is much less than its full legal liability. The actual liability which the company assumes in granting insurance at any time is technically known as the risk. The most important question in this connection is how the risk is determined. In seeking an answer to this question two things have to be taken into account, the amount which the company binds itself to pay, and the probability that it will have to make payment. These two factors will be considered in turn.

The maximum amount for which the company renders itself contingently liable is usually expressed in the policy. This amount ought in all cases to be limited to the insurable interest of the insured; that is, to the amount of loss he would actually suffer from the occurrence of the event against whose consequences he is insured. To promise a larger amount is to make it for the interest of the insured to bring about the occurrence of the event—a condition of things which is prejudicial to the welfare of the company, and contrary to public policy. In the insurance of property the attempt is nearly always made to apply this principle. In life insurance, however, and in other forms of insurance against loss of income from labor, no such attempt is made in many cases. A life insurance company does not undertake to limit the amount of insurance which any man may take out on his own life to the capitalized value of his income-earning capacity, any more than it limits his choice of beneficiaries to those who are actually economically benefited by his living. It cannot be denied that the results of this policy are in some respects very unfortunate. It leads to an increase in the incentive to commit two kinds of crimes, suicide and murder, and to a certain increase in the number of such crimes actually committed. That the situation is not intolerable is due to the fact that other motives are at work which are sufficiently strong in most cases to overcome entirely the economic motive.

Insurable interest, then, fixes the maximum amount for which a policy should be made out. Insurable interest may be defined as any legal or equitable right or interest such that the contingency insured against will result in financial loss to the insured. This definition, while not complete, covers the greater number of examples of insurable interest. Thus a mortgagee or pledgee has an insurable interest in the property mortgaged or pledged. A vendee of property under an executory contract of purchase has an insurable interest in the property. A common carrier or other bailee has an insurable interest in the goods bailed. The carrier also has an insurable interest in the prospective freight upon goods actually laden upon his ship or other vehicle for carriage. It will thus be seen that several different persons may have distinct insurable interests in the same property, and that these insurable interests may in the aggregate exceed the value of the property insured.

In general, no particular amount of insurable interest is necessary to make the insurance contract valid. It is enough if at the time of effecting the insurance policy the insured has some interest in the life or property insured. There is, however, one exception in the case of life insurance. Although in the case of insurance of the life of a relative the law does not require any limit to be placed on the value of the life insured, when the interest of the insured is purely financial, the insurance by a creditor of the life of a debtor, the amount of the insurance must bear some relation to the amount of the debt plus interest and the cost of insurance or it will be deemed void as a gambling contract.

One of the most important principles of the law of insurances is that the contract of insurance is a contract of indemnity only. It follows that in most forms of insurances the insurer must not only have an insurable interest at the time he effects the insurance, but that he must have an insurable interest at the time of the loss in order to recover on the policy, and the amount of the recovery will be measured by the amount of his insurable interest. The life insurance contract constitutes an exception to the rule. It is not strictly a contract of indemnity, but a contract to pay a fixed amount of money; and if the insured has an insurable interest at the time of effecting the insurance, so that the policy is then valid, he may recover the entire amount of the policy upon the happening of the loss even though the insurable interest has then ceased. Insurance policies, known as 'valued policies,' are sometimes written in which an agreed value is assigned to the interest of the insured. In the event of loss the insured must still have his interest in the property insured, but the value of his interest is determined by the policy. In several States insurers against loss by fire are required by statute to issue only valued policies.

When there are several insurers of the same interest in the same property, their position in the event of loss is not unlike that of co-sureties. If the amount of the several policies exceeds the value of the interest, the insured may not recover the full amount of property from the insurer, but each is required to contribute ratably to the loss; or, if the insured elects to recover the amount of the loss from any one insurer (as he may do in the absence of stipulation to the contrary in the policy), that one, on payment of the loss, may compel contribution pro rata by each of the other insurers.

In the case of marine insurance policies the insured is deemed to be a co-insurer with his insurer if the amount of insurance is less than the full value of the interest insured. The marine policy is therefore a policy of indemnity only if the property or interest insured is insured for its full value. If insured for less than its full value, the insured can recover on his policy only such proportion of the amount insured as the loss bears to the value of the whole interest of the insurance on the property.

The amount stated on the face of the policy is the maximum amount for which an insurance company may become liable. In some forms of insurance, as in life, accident, and sickness insurance, the amount stated in the policy is the amount actually paid if the specified event occurs, regardless of whether an equivalent loss is actually suffered or not. With most forms of insurance of property the situation is different. Whatever may be the face of the policy, the indemnity is not expected to exceed the loss actually experienced. If insured property is partially destroyed and the loss does not exceed the amount of the insurance, the amount of loss fixes the maximum amount to be paid as indemnity. In some countries in fire insurance any person who insures his property for less than its full value is held to be his own insurer for the difference between the value of the property and the amount of the insurance; and if the property is partially destroyed, and the loss does not exceed the insurance, the indemnity actually paid is such part of the loss as the total amount of insurance in force is of the total value of the property. If, for example, property insured for three-fourths of its value is partially destroyed, the indemnity actually paid will be three-fourths of the loss. The rest of the loss will fall upon the insured as co-insurer. In the United States this principle is not commonly applied except in marine insurance. In general, when insured property is partially destroyed and the loss does not exceed the amount of the insurance, the insurance company becomes responsible for the entire amount of the loss.

When the loss fixes the maximum amount of indemnity, it is clear that the amount stated in the face of the policy cannot be taken as the measure of the real liability which a company assumes in insuring a piece of property. It is true that there is an abstract possibility that every time a loss occurs it will be large enough to call for the full amount of the insurance; but there is a practical certainty that in many cases loss and indemnity will be less than the face of the policy. It is necessary, therefore, to calculate what is the probable ratio of the indemnity to the amount of insurance, or, in other words, to estimate the probable intensity of the loss. This can be ascertained, not by a study of the characteristics of the insured property, but only by the statistical analysis of the results of past experience. If it were shown by such analysis that for any particular kind of property the indemnity in a large number of cases had been on the average one-half the amount stated in the face of the policy, then the amount the insurance company would actually have at stake in a policy issued on property of that kind would be one-half the amount stated in the face of the policy.

Degree of Probability.—The determination of the probability of the occurrence of the event against whose economic consequences insurance is granted is a much more complex matter than the determination of the amount which the insurance company has at stake on a given policy. It is evident that this probability will vary with the length of time for which the insurance is to be in force; that, other things being equal, the probability of the occurrence of a chance event is twice as great for two years as for one year. It will be convenient to approach the problem by leaving out of consideration the element of time and assuming that all insurance is granted for a uniform period, say for one year. We may then consider what changes, if any, the introduction of the time element will involve.

It is to be noted in the first place that it is impossible to determine the degree of probability by the most exhaustive study of the individual risk. It is easy to see that there is more danger in one case than another; that, for example, other things being equal, a wooden house is more likely to be burned than a stone house, but what the absolute probability is in either case does not appear. Whether either will be destroyed or not is a matter of chance, though with different degrees of probability. By this it is not meant that the destruction is uncaused, but that the forces at work are so complex that human knowledge is incapable of analyzing them completely.

As it is impossible to determine the degree of probability directly, the attempt is made to discover it in an indirect way. The method is the application of the theory of probability to the statistical results of past experience. The average of the past is the probability of the future. If the records show that for a series of years an event has occurred 10 times a year for every 10,000 opportunities for its occurrence, the degree of probability that it will occur in a future year, conditions remaining unchanged, is denoted by the fraction 10/10,000, or 1/1000. The actual number of occurrences in any one year may vary more or less from the probable number as indicated by the average. The probable degree of this variation may be determined from the character of the past series. The greater the fluctuations in the series in the past, the greater the variations of actual from average that may be expected in the future. But whatever the character of the past series, it will always be true that increasing the number of opportunities, provided they are all alike, diminishes the probable variation of the actual number of occurrences in any future year from the probable number as determined by past experiences. To state the same principle in a form more directly applicable to insurance, the greater the number of similar risks included in a group, the smaller the percentage of variation between the average number of losses for a series of years, and the actual number of losses for any particular year.

The influence of time on probability under these ideally simplified conditions, that is, on the hypothesis that all circumstances affecting the degree of danger remain unchanged, is very simple. The probability varies directly in proportion to the time. For n years the probability is n times as great as for one year. If, then, we represent by a the amount which an insurance company has at stake on a given policy, by p the probability of the occurrence of a loss within one year, and by n the number of years for which the company issues its policy, we should have the annual risk assumed by the company represented by the formula $a \times p$, and the total risk for the n years represented by $a \times p \times n$.

The real difficulties involved in the attempt to estimate risk have not yet been touched upon. They are practical rather than theoretical. The determination of future events by the application of the theory of probabilities to the results of past experience proceeds on the basis of two assumptions; that all the cases included, whether past or future, are alike in all essential respects, and that the lapse of time brings no change in the factors affecting the degree of probability. Neither of these assumptions corresponds to the fact. As to the first we see that hardly any two lives or pieces of property are alike in all essential respects. In the case of fire insurance, for example, the number of circumstances affecting the probability of destruction is very great. It is only by overlooking many minor points and assuming a degree of similarity that does not actually exist, that the application of the statistical method is at all possible. The same considerations apply more or less to all other forms of insurance. The common practice is to group risks in classes, according to their more prominent elements, and collect data about the different classes from which to calculate the average. Each class has its own average and its own degree of probability. In estimating an individual risk the average of the class to which it belongs is used as a basis from which the particular risk is calculated by making allowance for any special conditions affecting it. The result is at the best a more or less close approximation to reality.

It is interesting to consider what the effect of the imperfect classification of risks is, both on the insuring companies and on the insured. To the companies it would make no difference of any kind, if all adopted the same classification and applied it in the same way. A general underestimating of risks would of course lead to ruin. But an imperfect classification, as a result of which there were as many risks overestimated as there were underestimated, would do them no harm. An average of all kinds of risks would be perfectly safe for them, provided all kinds of risks were charged for according to the average. Thus if there are ten risks, which, when properly estimated, amount to 1, 2, 3, and so on up to 10, the risk assumed by a company which insured them all would amount to 55; but the company is equally safe whether it charges each risk according to its proper value, 1, 2, 3, and so on up to 10, or charges each of them according to the average risk, which is 5½. Where there are competing companies, however, and one estimates risks more closely than the others, the result of imperfect classification is an unfavorable selection of risks. If one company assumed all risks from 1 to 10 at their proper valuation, while another assumed them all at the average valuation of 5½, the former company would get all the small risks, those from 1 to 5, and the latter the large ones, those from 6 to 10. We see, then, that where all insurance companies use the same classification, they have no incentive to perfect their system, but where one company introduces a more accurate classification, others are constrained to do the same or suffer from adverse selection.

The effect of imperfect classification of risks upon the insured is to cause a disproportionate distribution of the burden of insurance. In an ideal system this burden would be so distributed that each person would pay to the company in proportion to the risk he brought upon it. This ideal can never be reached, but the more nearly exact the calculation of risks, the more closely is the ideal approximated. The extent to which the attempt is made to estimate the risks accurately varies in the different forms of insurance. It is probably carried furthest in fire insurance, while in life insurance and other similar kinds comparatively little attention is paid to it. Most life insurance companies recognize only two classes of risks, those which come up to a certain standard and those which fall below it. The latter are rejected, while the former are all accepted at equal rates for equal ages. Yet in many cases the examining physicians would have no hesitation in declaring that some of those accepted would in all probability live longer than others. The result of this imperfect classification of risks is like that already noted, that in the long run the stronger and healthier lives pay a part of the cost of insurance of those possessing less viability. This injustice is partially eliminated through the return to the insured of a part of their premiums in the form of dividends, of which the longer lives receive the larger share. But that can mean no more than that the premium rates are scaled so high that the excess paid by the stronger lives is sufficient to make up the deficiency on the weaker and leave a remnant to be returned as dividends.

The fact that most insurance companies refuse to insure lives that do not come up to a certain standard suggests the question, What is an insurable risk? The answer clearly is that any risk—that is, any chance of loss depending on the occurrence of any uncertain event—is insurable, provided there are sufficient data to enable the degree of probability to be estimated, and provided it is of such a nature that the insured cannot too easily make use of the insurance for his own economic advantage. However hazardous the risk, it may be covered by putting the premium high enough. It is sometimes stated that only those risks are insurable which threaten a large number of individuals at the same time. The larger the number of risks, the more closely the degree of probability can be estimated; but it is possible to make some estimate of it on the basis of a very small number of risks, and cover the high degree of uncertainty by a high premium rate. No more is it true that the danger must be of such a nature that the loss cannot actually befall a large proportion of the insured at the same time. Here again it is a question of putting the premium rates high enough and accumulating large reserves. If every one of the insured lost at the same time, the company could meet the loss provided it had estimated the risks correctly. Nor, finally, does it make any difference how great the danger of loss may be. It is simply a matter of adjusting premiums to risks. A life insurance company insuring only the lives of consumptives might be on just as sound a financial basis as one which made a specialty of insuring only extra-healthy lives.

But while the theory of insurance is equally applicable to all forms of uncertain losses, its actual extension is limited by practical difficulties. The chief one of these is the impossibility of inducing people to pay the high rates which would make it safe for a company to assume very hazardous risks. Unless there is considerable difference between the uncertainty to which an individual is exposed and that to which an insurance company is exposed from the same risk, the gain from insurance becomes very slight, when the cost of conducting the business is added to the first cost of the insurance. It is evident, however, that many risks are still untouched by insurance companies which offer a fair field for their activity.

One other point in connection with the subject of risks deserves brief consideration. While it is the purpose of insurance to reduce the burden which chance losses bring upon society, one of its consequences is an increase in the actual amount of loss. This is due to the effect of insurance upon the mind of the insured. An honest man may become less careful in protecting his property, a dishonest man may even seek to destroy his for the sake of obtaining the insurance. The danger of the loss through the carelessness or misconduct of the insured is commonly referred to as 'the moral risk.' It constitutes one element in every risk that the insurance company assumes, and one which in general it is very difficult to estimate. It is for the interest of the company to reduce the danger as much as possible, and it is contrary to public policy to allow them to increase it unnecessarily. Various forfeiture provisions are inserted in policies for the purpose of compelling greater carefulness and reducing misconduct. The chief reliance, however, must be on the strict application of the principle of insurable interest. It may even be practically advantageous to limit the amount of insurance to a certain percentage of the insurable interest in order to create a positive incentive to carefulness and honesty. It would at least be expected that the insurance companies would use all diligence to detect extra hazardous 'moral' risks and avoid them. That they did not always do so in the past the history of marine insurance abundantly proves. How far they come short of doing it to-day can be inferred from the following statistics compiled from the annual reports of the Massachusetts State Fire Marshal to the Insurance Commissioner.

In the report for 1896 forty per cent. of the insurance-defrauding fires are said to have been the work of parties with a record, that is, who had previously collected or attempted to collect insurance from one to eight times on fires of a suspicious character. Of 143 insurance-defrauding fires mentioned in the report for 1897, 16 were set by persons who had had one or more previous fires, one of whom had had 16. Of 111 such fires in the report for 1898, 18 were set by persons who had had one or more previous fires, one of whom had had 6. Of 154 such fires mentioned in the reports for 1901 and 1902, one of the insured had had six previous fires, one had had five, two had had three, two had had two, and 25 had had one. The apparent increase in the later years in the proportion of these fires set by persons with a record may be due to greater activity on the part of the fire marshal and his assistants, but there is certainly no indication of any improvement in the practice of the insurance companies.

Such a state of things speaks for itself. The chief source of the trouble is undoubtedly to be found in the agency system, which makes the income of the agents depend upon the amount of business they write, regardless of its character.

The Premium.—The amount paid to the insurance company by the insured is called the premium. It consists of two parts, the 'natural premium' and the 'loading.' The amount of the natural premium is determined by the risk, or, to speak more precisely, it equals the risk. The loading is the amount added to the natural premium to cover the cost of insuring the risk. In other words, the natural premium pays the losses and the loading pays the expenses. The insured in any company must pay all the losses and all the expenses of the company, interest on the capital invested in the business included. This cost of administration is distributed among all the insured, each contributing a certain proportion of his natural premium.

It is interesting to consider what part of the entire premium is natural premium and what part is loading. In life insurance natural premiums are actually calculated and loadings added to them. In many forms of insurance, however, no such division is made in practice, but the whole premium is estimated together. In such cases the proportion of loading can be discovered only by an examination of the expense account, which will reveal what part of the receipts from premiums has been returned to the policy-holders and what part has gone for expenses. It will be found that the proportion of loading varies a great deal from one kind of insurance to another, and from one company to another. In some cases the loading does not exceed 20 per cent. of the natural premium, in others it is as high as 100 per cent. The high expense account of the insurance companies is a great social burden. It enhances the cost of insurance and thus retards its growth. By far the largest single item in the expense account is usually under the head of commissions to agents, the generosity of which is defended on the ground that large commissions are necessary to promote the extension of the business. Thus for the purpose of persuading more or less unwilling persons to insure, the cost of insurance to the entire body of insured is increased. It would be an experiment worth trying whether among people familiar with the practice of insurance a company could not be operated at a cost so much below that of the present system that it could offer insurance at rates with which existing companies could not compete, at least without radical changes in methods of management.

While from the social point of view the loading represents the cost of insurance, for a person seeking insurance the entire premium constitutes its price. He is consequently interested in the question whether the competition of insurance companies may be relied on to reduce the price to the lowest point consistent with absolute safety. It is evident that the competitive principle would operate in this field at a tremendous cost. Competition works through the elimination of the least efficient. The failure of an insurance company, however, may entail a far greater loss on the insured than it does on the insurers. The severity of the process of elimination has been greatly mitigated by the action of legislatures, many of which have provided for the compulsory winding-up of the affairs of a company on the appearance of certain indications of danger, while the company is still able to take care of the insured by reinsuring its risks. Furthermore, the very uncertainty which constitutes an essential element of the insurance business makes unrestricted competition particularly dangerous. During a series of good years, when losses ran below the average, there would be an almost irresistible tendency to reduce the price of insurance to the level made possible by the prevailing favorable experience. If years of unusually high losses followed, as they naturally would follow, the company would find itself hard pressed to meet its obligations. Thus there is always the danger that competition would reduce the cost of insurance below the margin of safety.

Is competition the force that is actually regulating the rates of insurance? There is keen competition among the agents of different companies, but it does not manifest itself in a fall in rates. The agents have no authority to make reductions. There are occasional periods of actual competition between companies, but for the most part they retain schedules of rates founded on a basis reached by common agreement. The statute books of our different States contain many laws which were enacted for the purpose of preventing such agreements and securing competition, but they have accomplished little. The opportunities for secret agreements are too numerous. For the most part the companies do not seek to extend their business by lowering rates; they rely on the persistence of their agents and the attractive features of their policies. It cannot be questioned that as a result the cost of insurance is higher than it ought to be. As between competition with its exceptional costliness, and combination with its excessive premium rates, the choice is not easy. The only escape is through governmental action, and at some future time the choice is likely to arise between governmental management of the business of insurance and governmental regulation of the rates of private companies.

The Insurance Contract.—The agreement between the insurer and insured constitutes the insurance contract. This contract is of a kind which in some respects resembles a wager, and a few writers have been misled into identifying the two forms. In both cases one party to the agreement binds himself to pay a certain sum on the occurrence of an uncertain event. The event may be the same in the two cases. Thus a house may be insured by its owner and at the same time may be the subject of a wager between two disinterested persons, so that if the house burns each of the two men receives the amount stated in the agreements. The illustration brings out the fundamental distinction between insurance and gambling. The one is the transfer of an existing risk from the person exposed to it to another party; the other is the voluntary creation of supposedly equal risks by two persons, neither of whom was before exposed to the risk. It is this principle that underlies the legal doctrine of insurable interest, in accordance with which the courts distinguish between insurance contracts and wagers. In the case of life insurance, as we have seen, this doctrine is very imperfectly followed.

The real subject matter of the insurance contract is security. The insured buys security by the payment of the premiums. The insurer performs his part of the contract just as much in the case of those of the insured who escape loss, and to whom consequently no indemnity is paid, as in the case of those who suffer loss and receive indemnity from the insurer.

The insurance contract is one of good faith. The insured is bound to reveal to the insurer all circumstances within his knowledge which have any bearing on the possibility of loss. The willful misrepresentation of any material fact, that is, of any fact affecting the probability of loss, usually works the forfeiture of the insurance.

The insurance contract is a personal one; it is between the company and the person taking out the insurance. A transfer of the insured property does not transfer the insurance, but renders it void, since the insured no longer has the insurable interest. In practice, however, insurance companies frequently allow the transfer of insurance to be effected by indorsement. This personal character of the contract makes it possible to control to some extent the moral risk. If the insurance went with the property insured, the company would have no protection against the passing of the insurance into the hands of a person whose reputation showed him to be an undesirable risk.

The Policy.—The writing in which the insurance contract is set forth is called the policy. This consists of two parts, the application of the person desiring insurance, and the agreement of the company to give it. The application is expressly stated to be a part of the contract. In it the applicant sets forth all the material facts about the risks which he desires insured. Some of the statements are representations, others are warranties. In many policies there is an express provision that every statement of the insured in his application shall be regarded as a warranty. A misstatement in a warranty, whether it is material or not, works forfeiture of the policy. A misstatement in a representation does so only when it concerns a material fact. A misstatement is material whenever it induces a company to enter into a contract which it would not have accepted if the truth had been known. Common forms of representations or express warranties are the statement that there is no other insurance upon the property, statements as to the location of the property, or as to the character of the business carried on in or upon the property, and, in the case of life insurance, statements as to business or condition of health of the insured. In contracts of insurance other than marine insurance, warranties must appear directly or by reference upon the face of the policy; but in marine policies there are three important warranties implied by law, irrespective of the terms of the policy. See article on MARINE INSURANCE.

Waiver or Estoppel.—Growing out of the doctrine of representation and warranties is the important doctrine of waiver, or estoppel as it is somewhat incorrectly called. As the effect of misrepresentation or breach of warranty is to give the insurer the right to avoid the policy, the right itself may be waived either expressly or by the contract of the insurer. Thus the receipt and acceptance of a premium by the insurer with knowledge by him of a breach of warranty waives the breach, and renders the contract valid.

Upon similar grounds, if the insured gives imperfect or ambiguous answers to the questions asked by the insurer at the time of effecting the policy, the insurer is declared to have waived fuller or more specified answers and cannot avail himself of a defective answer as a ground for avoiding the contract. The question of waiver, or estoppel, has frequently arisen in cases where the written application for the insurance policy, which is made a part of the policy, is filled in by the agent of the insured, although signed by the applicant. If the agent does not correctly transcribe the answers of the applicant for insurance, it is open to the insurer, in event of loss, to rely upon the untruth of the written answers as a breach of warranty avoiding the policy. In many States the courts have held that the insurance agent, although in fact doing an act expected of and attributed to the insured, remains the agent of the insurer, and that the insurer, through his agent having notice by the answers of the insured of the matter relied upon by the insurer as a breach of warranty, and having after such constructive notice issued the policy with full knowledge of the alleged breach of the written terms, is estopped from relying on the breach as a defense to his liability on the contract of insurance. While the doctrine undoubtedly works out substantial justice, it has been subject to severe criticism on the ground that it is not a true estoppel (see ESTOPPEL), and that it violates the parole evidence rule (see EVIDENCE) in permitting the insured to contradict the written answer contained in his application.

Life insurance policies are freely assignable, and if issued in good faith to one having an insurable interest, the assignee need not have an insurable interest in the life insured. Policies of marine insurance are also freely assignable; but as the marine policy is purely one of indemnity, it is necessary that the assignee should acquire the interest insured in order to recover on the policy. Fire insurance policies, owing to the importance of the personality of the insured, can only be assigned with the consent of the insurer.

The policy contains precise statements as to the conditions under which the insurance will be forfeited, the conditions under which the indemnity becomes payable, and the procedure by which the insured is to prove loss and obtain the indemnity. Sound policy would seem to require that all these conditions should be of such a nature that they would put no unnecessary obstacles in the way of honest insurance, and set forth so clearly that the insured could have no excuse for misunderstanding the exact nature of the contract he has entered into. The better class of insurance companies have undoubtedly aimed to give the insured fair treatment. In too many cases, however, companies have shown a disposition to take advantage of obscurities or technicalities in the contract to avoid paying honest losses. So prevalent has this practice been that the legislatures of many of our States have considered it necessary to come to the protection of the policy-holders. For example, the practice of printing some essential feature of the policy in very small type so that it easily escaped the notice of the insured has been met by legislation prescribing the smallest size of type that may be used; the requirement of formalities in proving claims which in many cases the insured are unable to fulfill has been declared illegal and not binding.

In interpreting all the claims of the insurance policy, it is a general rule that, inasmuch as the insurer in fact proposes the policy and fixes the terms, the terms of the policy will be construed most strongly against the insurer. Thus, a policy which stipulates that the building insured is 'detached fifty feet,' in the absence of express language to the contrary will be deemed to mean detached fifty feet from any building affecting the risk, and not from any building irrespective of the character.

B. KINDS OF INSURANCE COMPANIES AND THEIR CHARACTERISTICS. *Public and Private Insurance.*—Insurance companies may be classified in various ways according to the characteristics on which the classification is based. Thus with respect to the nature of the insuring body public insurance may be distinguished from private insurance. Public insurance is insurance issued by a body politic, whether nation, State, or a minor civil division; private insurance is insurance issued by a private person or by a group of private persons. Public insurance will be discussed in the concluding part of this article.

Mutual and Joint-Stock Insurance.—Private insurance may be further subdivided into mutual insurance and insurance for gain, sometimes called commercial insurance. In its simplest form a mutual insurance company is based on an agreement entered into by each member to pay a share of the loss sustained by any other member from certain specified causes. The proportion to be paid by each member is based on the risks to which he himself subjects the company. Mutual insurance is seldom found except in the case of risks which are nearly uniform in character, so that the degree of risk varies almost invariably with the amount of insurance. Thus we find one class of mutual fire insurance companies insuring cotton-mills, another insuring packing houses, a third insuring farm buildings, and a fourth confined to city dwellings. It is the comparative uniformity of the risks involved, which has been partly responsible for the general application of the mutual principle to life insurance.

When the funds to reimburse losses are collected by assessment after the occurrence of the loss, the annual contribution of each member, that is, the cost of his insurance, is more or less uncertain. As has already been pointed out, insurance in a mutual company collecting its funds in that way is the substitution of a smaller degree of uncertainty for a greater degree, of the prospect of making small annual payments varying within a comparatively slight range for a much smaller probability of a far greater loss. The more regular the loss from year to year, the less are the fluctuations in the assessments, and therefore the more advantageous the insurance on the mutual plan. The relatively great regularity of loss from year to year has made possible the application of the assessment principle to life insurance to a far greater extent than to other kinds.

Very few mutual insurance companies are now run on the pure assessment principle. In nearly all companies there is some accumulation of reserves which may be used to equalize the premiums in spite of considerable fluctuations in the amount of loss. Some of the older companies, especially in fire insurance, have thus accumulated very large reserves, which enable them to return to the insured in the form of dividends a considerable part of the premiums collected.

It is in life insurance that the mutual principle is applied most extensively. The practical difference between the old-line mutual companies and the joint-stock companies is very slight.

Of the three life insurance companies in the United States having over $1,000,000,000 of insurance in force, the Mutual and the New York are mutual companies, while the Equitable is a joint-stock company. The capital stock of the Equitable, however, is only $100,000, and the annual dividend of 7 per cent. accounts for only $7000 out of a total annual disbursement of nearly $40,000,000. The share of the $7000 assessed against each of the 400,000 policies in force is a negligible element in the cost of insurance. The capital stock of a stock company is of importance only so long as it constitutes a considerable part of the fund which guarantees security to the policy-holders. This is the case only while a company is small. All the older companies have surpluses over and above the amount legally necessary for the protection of the policy-holders which far exceed the amount of the capital stock. For example, the Equitable has a surplus of nearly $75,000,000. Even in the case of companies with a large capital stock like the Prudential and the Metropolitan, each of which is capitalized at $2,000,000, the surplus is several times as large as the capital stock.

Mutual companies are most numerous in fire insurance. These are small companies, usually confining their operations to a limited area and to some one or two classes of risks. The reason for their existence is usually to be found in the belief, whether justifiable or not, that the stock companies are not managed as economically as they ought to be, thus enabling the mutual companies to make a saving in the cost of management; and that the particular kind of property in question is improperly classified, and the premium rate in consequence unjustifiably high.

Individual Underwriting.—Insurance for gain is most commonly issued by joint-stock companies, but sometimes by individuals. There is no reason why insurance issued by a single person might not be as secure as that issued by a joint-stock company, provided the insurer sets aside a sufficient guarantee fund. As a matter of fact, however, comparatively little insurance is written by individuals. Some of our States have gone so far as to prohibit the practice entirely, influenced largely by the constitutional and other difficulties in the way of exercising adequate supervision. In marine insurance, however, individual underwriting is still common. In the English Lloyds it is the prevalent form of insurance. Within recent years attempts have been made to establish an ostensibly similar form of underwriting in the fire insurance business in the United States. The promoters of the American Lloyds have claimed exemption from the jurisdiction of the Insurance Departments on the ground that they were not insurance companies within the meaning of the law. They still enjoy this exemption in a few States, but there is a general tendency to bring them under the same regulations as apply to joint-stock companies. Few of the Lloyds survive after their freedom of action is thus restricted. It is to be noticed, however, that the failure of so many of them is due, not to the practice of individual underwriting in itself, but to the fact that the ostensible reserve for the protection of the policy-holders has usually been of little real value.

The most obvious classification of insurance companies is on the basis of the kinds of risks which they assume. Thus we have fire insurance companies insuring against loss by fire, marine insurance companies against loss at sea, plate-glass insurance companies against the breaking of plate-glass windows, and so on. Some companies confine their business to one kind of risk, while others assume two or more kinds. This division of the field of insurance among different companies is purely a matter of practical convenience of administration. There is no *a priori* reason why one company should not issue insurance against all kinds of insurable risks; in fact, the theoretical arguments are all on the side of such action. So long as each risk is correctly estimated according to the principles already pointed out, the more risks the company assumes the more cheaply it can afford to grant insurance, since the element of uncertainty in the amount of loss to be expected constantly diminishes as the number of risks increases. The combination of fire and marine insurance on the one hand, and of life and accident insurance on the other, is by no means unusual, and outside of these forms the tendency seems to be for companies to extend the field of their activity. Thus the Fidelity and Casualty Company of New York has a charter authorizing insurance of "any contingent event whatever, life, fire, and marine risks excepted, which may be the subject of legitimate insurance." The company actually carries on the following kinds of insurance: Accident, burglary, employers' liability, fidelity and surety, plate glass, and steam boiler.

By far the largest part of the insurance in force is for protection against loss through the destruction of property by the action of natural forces. This is the case, for example, in fire, marine, plate glass, tornado, steam boiler, and elevator insurance, and in most forms of so-called agricultural insurance, such as insurance of live stock and growing crops. The chief differences between these various forms are connected with the technique of the business rather than with its general principles. Thus the body of data from which to calculate average losses is much smaller in some kinds than in others; the difficulty of determining the amount of loss varies greatly from one kind to another; and the moral risk involved in the various kinds is very unequal.

The class of insurance which ranks next in importance is made up of those forms which undertake to give indemnity for the loss of income through the sickness, injury, or death of the person insured or his inability to obtain employment. Life insurance is treated in a separate article under that title. Other forms of insurance in this class deserve brief notice on account of their great social significance.

Sickness and Accident Insurance.—Sickness insurance and accident insurance are carried on under various forms. There are a number of joint-stock insurance companies in the United States and in foreign countries which issue accident insurance policies, and a considerable number which guarantee weekly indemnity in case of sickness from certain specified diseases. Many fraternal associations and trade unions assure their members indemnity for loss of income through accident or sickness. Several large business corporations have established funds for the insurance of their own laborers against accident or sickness or both, in some of which membership is voluntary, in others compulsory. Finally, several European countries, following the lead of Germany, have introduced a system of governmental insurance of working men against certain contingencies, sickness and accident included. Private accident insurance was first introduced into the United States in 1863, though one or two railways had previously attempted to sell tickets insuring travelers over their own lines. The development of the business was very rapid. It was taken up by many insurance companies and for a time by several railroads. Short-time insurance of travelers still constitutes a very considerable part of the business of accident companies, though general policies, usually covering a year, are now common. In many companies these policies are limited to accidents which result in death or total disability. Some companies, however, issue policies which cover also certain specified injuries of a permanent nature, such as the loss of an eye, a hand, or a foot. The indemnity varies with the nature of the injury and the amount of the premium.

Commercial sickness insurance is as yet offered by only ten or a dozen regular insurance companies in the United States. The policies generally guarantee a weekly indemnity during illness or for a limited period, in case of certain specified diseases. Sometimes the company undertakes to pay a stated lump sum for a permanent disability such as total blindness or paralysis.

The moral risk constitutes a very large element in both accident and sickness insurance, especially in the case of laborers with small incomes. Merely limiting the indemnity to an amount less than the wage of the laborer does not remove all incentive to simulate or even bring about the disability which entitles the insured to indemnity. He is comparing not merely daily indemnity with daily wage, but indemnity and idleness with wage and eight, ten, or twelve hours of work. Experience has shown that the moral risk can be much better controlled where the insurance is granted by a body like a trade union or a lodge. Here the knowledge the members have of one another's affairs affords a more efficient check upon malingering than any which a regularly established insurance company is able to use. Hence it is not surprising to find that by far the largest part of the insurance of workers against sickness and accident, in those countries where the Government has not taken up the business, is in the hands of these organizations of the laborers themselves.

Employers' Liability Insurance.—Closely allied to accident insurance is the insurance of employers against claims for damages arising from accidents to their laborers, so-called employers' liability insurance. This form of insurance, like the preceding, originated in England. It was introduced into the United States in 1886 by a London insurance company. There are now twelve or fifteen companies engaged in the business in this country. They no longer confine their operations to the employers' liability for accident to his employees, but cover also liabilities for accidents to persons not in the employ of the insured. Railroad corporations, construction companies, manufacturing concerns, protect themselves in this way. The risk varies greatly in different occupations and there is a corresponding variety of premium rates. The schedule of classifications adopted by the companies embraces nearly a thousand different kinds of risks. The development of the business in recent years has been greatly accelerated through the general extension by statute of the liability of the employer for indemnity for accident which he was not obliged to indemnify under the common law.

Unemployment Insurance.—Insurance of workers against loss of income on account of lack of employment presents greater difficulties than those involved in accident insurance. The moral risk here becomes very great. Such insurance has never been carried on successfully by commercial insurance companies. Many of the trade unions pay out-of-work benefits to their members, but the business is not run on scientific insurance principles. In none of the benefits paid by the trade unions is there any attempt to correlate the risk and the assessment, nor is there any separation of the insurance fund from the other funds of the union. Unemployment insurance has been tried by some of the Swiss communes, but with poor success. It is an unfortunate fact that insecurity of employment, which constitutes such a serious evil in the life of laborers, is a form of uncertainty with which it is extremely difficult for insurance to deal.

Fidelity and Surety Insurance.—Of the remaining forms of commercial insurance two are of special interest, fidelity and surety insurance and credit insurance. Fidelity and surety insurance is almost entirely the growth of the last fifteen years, and yet the amount written in the United States in 1901 exceeded $1,700,000,000. Fidelity insurance, according to the distinction made by the New York State Insurance Department, consists in giving bonds for the honesty of employees and public officials, while surety insurance consists in going on the bonds of administrators and executors of estates. This kind of insurance is interesting as illustrating the regularity in human conduct to which Quetelet first called attention. It is only because of the comparative regularity in the annual number of defalcations and similar crimes that the insurance company is able to assume the risk of such occurrences for a premium small enough to make the business practicable.

Credit Insurance.—Credit insurance undertakes to indemnify merchants and business men who give credit for losses through bad debts. This form of insurance was first introduced into the United States about 1890. In 1893 there were four American companies in the business. Of these companies three have since failed. In 1895 one foreign company was admitted to practice in New York. The risks written in 1901 by the two companies in operation amounted to nearly $22,000,000. The successful prosecution of this form of underwriting is extremely difficult, owing to the high degree of moral risk involved. To guard as far as possible against the abuse of the system by the insured, a very ingenious method was adopted. The insurance applied only to credits given to persons with a rating in the mercantile agencies, and the amount of credit to be given to them was usually limited to 20 per cent. of their lowest capital rating. Moreover, the insurance did not apply to any particular credit, but was based on the average loss for a year. The person applying for insurance was required to furnish a statement of the amount of his credits and the amount of his losses from bad debts for a number of years, and the average annual ratio of losses to credits was ascertained. The insurance applied only in those years when the ratio of loss to credits exceeded the average, and covered only the excess of the loss above the average. The failure of three out of four companies is not conclusive evidence that the business cannot successfully be carried on, since the period of depression beginning in 1893 subjected them to a severe strain before they were well established. The business of the surviving companies is rapidly increasing, and seems to be reasonably profitable.

There are many other interesting applications of the insurance principle which must be passed over without notice. As indications of its possible development may be mentioned the following instances. The saloon-keepers in a particular city form an association which undertakes to pay an indemnity to any member who is unable to secure a renewal of his license; the newspaper publishers of Finland enter into an agreement to indemnify one another for losses incurred through the suppression of particular issues of their papers by the order of the Russian Government; finally, the manufacturers of Austria bind themselves to pay indemnities for losses occasioned by strikes instituted by workers in their factories.

Preventive Activity of Insurance Companies.—In comparing premiums and indemnities for the purpose of ascertaining the actual cost of the administration of the insurance business, it is necessary to bear in mind the fact that insurance companies carry on other forms of activity besides guaranteeing indemnity. One of the most prevalent of these forms is their preventive activity, under which name may be included all the efforts which the companies make to prevent the occurrence of the event against whose consequences they grant insurance. The relative amount of such activity varies greatly in the different kinds of insurance. There is very little of it in life insurance. In accident insurance we find the companies distributing books and pamphlets containing information as to the first aid to the injured. It is in the insurance of property, however, that such activity is most common. In the case of elevator and steam-boiler insurance a very considerable part of the expense of management is due to the systematic inspection of insured elevators and boilers which the companies carry on.

In the early days of insurance the distinction between insurance and prevention was not very sharply drawn. The early English fire insurance companies, for example, laid special emphasis on the service which they rendered the community through the maintenance of fire brigades. A survival of this confusion of ideas can be seen in the legislation of many of our States compelling fire insurance companies to support wholly or in part the fire service of the cities. Whatever payments the companies make for such service are made out of the funds collected from the insured. The injustice of compelling a limited number of property-owners, the insured, to support such an institution as the fire department, intended for the benefit and use of the whole community, seems too obvious to need argument.

While life insurance companies do little or nothing to prevent the occurrence of loss, only a small part of their activity can be strictly called insurance. A very large proportion of the premiums they receive are rather in the nature of investment. The relation between the two forms of activity is discussed in the article on LIFE INSURANCE.

Re-insurance.—The custom of re-insurance which prevails to a great extent among insurance companies may be briefly described. To avoid the possibility of being called upon to pay excessive indemnities at any time, insurance companies are accustomed to limit the amount of insurance that they will carry on any one risk. The maximum risk carried by one company may be $10,000, that of another company $50,000. If a company insures a piece of property for more than the maximum risk it carries, it protects itself by re-insuring the excess in another company. The practice of re-insurance is naturally seldom found among mutual companies, but it is very common among stock companies. Many of the latter have from 10 to 20 per cent. of the risks they have assumed re-insured, while occasionally one is found with three-fourths of its risks so protected. Conversely, there are companies which devote themselves entirely to the practice of re-insurance, issuing no policies directly to property-owners.

C. RELATION OF THE GOVERNMENT TO INSURANCE. The economic and social value of insurance can hardly be overestimated. The application of the insurance principles in the production of wealth reduces materially the cost of commodities and services; the proceeds of life insurance policies keep many families from want or charity; while the peace of mind which insurance creates is certainly of great value. It is therefore of great importance that the system should be widely extended, and that as many people as possible should enjoy its advantages. It is pertinent to inquire whether the management of insurance by private companies is as efficient as it ought to be; whether there are any *a priori* reasons for expecting better results from governmental management; and what has been the experience of such governmental insurance offices as have been already established.

The first requisite of a satisfactory system of insurance is security. In this respect no criticism can be brought against the older companies in the established lines of insurance. It must be admitted, however, that while many companies have of their own initiative adopted such methods as are calculated to secure their stability, many others have been reckless or even dishonest in their management. The total amount of money collected in the form of insurance premiums by companies which have failed to make the agreed returns to the insured is very large. The general high level of security in the insurance business in the United States is due to no small extent to the stringent requirements of the insurance departments in the various States.

The second requisite of a satisfactory system of insurance is cheapness, premium rates as low as is consistent with safety. In this respect the results of private underwriting leave much to be desired. As already pointed out, unrestricted competition would be both an imperfect and an extremely costly method of regulating rates. As a matter of fact, in the United States, competition has comparatively little influence in fixing rates or compelling economies of management. In all lines of insurance the rates are fixed by agreements, and the attempts of the legislatures of various States to reinstate competition by legislative fiat accomplish practically nothing. It may be true that in many cases the rates are none too high to cover losses and expenses as insurance companies are at present managed, but in many cases losses, and in practically all cases expenses, are unnecessarily high. It is one of the advantages of unrestricted competition that it forces the adoption of economical methods. In the insurance business, however, such competition as survives does not result in cheaper methods and a lower cost of insurance, but rather in the expenditure of larger sums in the attempt to secure new business, and in the presentation of more attractive but more expensive methods of settling policies. Moreover, altogether aside from the question of cost within a single company, large numbers of companies, and the consequent multiplication of managers, agents, and material equipment, greatly increase the cost of insurance. There is no other line of economic activity in which the gain from production on a large scale is so great as in the insurance business.

With respect to security, governmental insurance clearly has the advantage. Nothing could be more secure than the insurance policy guaranteed by the Government. With respect to cheapness the case is not so simple, though the advantage would probably be with the Government office. The possible saving in the actual management of the business would be enormous, and the large scale on which governmental insurance could be carried on would greatly reduce its cost. It would be unnecessary for the Government to accumulate large reserves when the number of the insured had become so great that the amount of loss was practically uniform from year to year. The only reason why there can be any uncertainty as to the comparative economy of governmental insurance and private insurance is that the Government is generally a wasteful manager; but in this particular case the opportunities for economy are so numerous that it seems hardly doubtful that the net cost of insurance would be lower if the entire business were in the hands of the Government. The difficulties in the way of governmental insurance are of a political nature, and that they are very serious cannot be questioned. The business would present unlimited opportunities for the manifestation of favoritism for the purpose of furthering personal and political ambition. So that while an ideally managed governmental insurance would be far preferable to the present system of private underwriting, the political evils which would result might be so great that they would overbalance the economic gain.

The experience of the governmental offices already established does not afford conclusive evidence either for or against public insurance. Public fire insurance offices have been maintained for many years by some of the Prussian towns and by some of the Swiss communes. All sorts of methods have been tried—governmental monopoly with compulsory insurance, governmental monopoly with voluntary insurance, compulsory insurance with choice of public or private office, and voluntary insurance with the same choice. The experience of the public offices is, on the whole, unfavorable to governmental insurance. The governments have generally found it necessary either to introduce a large amount of formality and supervision, thus rendering the business unpopular, or to adopt a loose classification of risks, which, in cases where the competition with private companies was allowed, resulted in the better risks going to the private companies with a more accurate classification, and the poorer risks going to the Government office. Finally, all these public offices are on so small a scale, generally limited to a single town or commune, that they have failed to realize the great advantage which comes from a large number of well-distributed risks, viz. the relatively slight fluctuation in loss from year to year.

The English Government has for nearly forty years offered life insurance to its citizens through the Post-office Department. It has made no attempt to develop the business, either through personal canvassing by its agents, after the manner of private companies, or through advertising. The amount of business written has been very small. This experience, however, is not conclusive as to the results of a similar experiment in the United States, where the habit of insurance is more thoroughly established than in any other country, except possibly New Zealand.

New Zealand furnishes the only example of a thoroughly successful governmental life insurance office. In this case, however, the success of the office has been largely due to the deliberate adoption of the methods of private companies, especially the solicitation of business through agents paid by commissions. This has prevented the office from realizing any great economies of management, and its rates do not differ much from those of private offices. New Zealand is said to have a greater per capita amount of life insurance than any other country, and a little over half the business is taken out through the public office.

The experience of European governments in establishing compulsory insurance of workingmen is of little service in estimating the value of governmental insurance. Germany has the most thorough system of workingmen's insurance, and its methods may be taken as typical. The business is organized in three separate departments—accident insurance, sickness insurance, and old age and invalidity insurance. All the indemnities paid for accidents, as well as the cost of administration, are borne by the employers; the laborers make no contribution in any form. To the indemnity for sickness and the cost of management the employers contribute one-third and the laborers two-thirds. The cost of management of the old age and invalidity insurance is borne by the Government, and the Government also makes a contribution to every pension granted; of the remainder of the pension, one-half is paid by the employers and one-half by the laborers. It is clear, therefore, that it is only by a loose use of language that the term insurance can be applied to the system. It is in reality an elaborate system of poor relief, and its success or failure has little significance for the question of the practicability of the public management of insurance on scientific principles. The conclusion is therefore unavoidable, that while the economic and social benefits of insurance are beyond dispute, and while the advantages of an ideally perfect system of governmental insurance would be many and great, the political dangers involved in the extension of governmental activity into this field, and the experience of such governmental offices as have already been established, both point to the necessity of extreme caution in attempting to introduce the system of governmental insurance.

The only feasible alternative to governmental management of the insurance business is governmental regulation of private companies. This is the method actually in use in nearly all civilized countries. The degree of regulation and supervision varies greatly from one country to another. There is as little of it in England as in any country, and as much of it in the United States as anywhere. In the latter country each State regulates the business within its own borders, and imposes such restrictions on the activities of the companies as it sees fit. The most general provisions are the requirements of annual reports from the companies, exhibiting in detail the business for the preceding year, and the requirement of a reserve bearing a certain ratio to the amount of insurance in force. Some of the States have shown a disposition to impose vexatious conditions upon the companies, the only effect of which is to increase the cost of insurance within their borders. But however reasonable the laws of each State, considered by themselves, may be, the variation in the requirements of different States, and the multiplication of reports and examinations, impose a great deal of unnecessary expense on the companies, all of which in the end must come out of the policyholders. Insurance men and State officials alike join in the attempt to bring about greater uniformity among the requirements of the different States. It would be a great gain in this respect, as well as for other reasons, if the National Government would take over the regulation and supervision of the insurance business. Unfortunately, the United States Supreme Court, in the case of Paul *vs.* Virginia, has ruled that the business of insurance is not commerce; that consequently it is not interstate commerce when an insurance company incorporated in one State carries on business in another; and that, therefore, the regulation of the business is reserved to the individual States.

Bibliography. The English and American writings on insurance are nearly all of a technical or practical character. The only general work of any great merit in the English language is Walford's *Insurance Cyclopædia* (London, 1871-80). Of the numerous general works in French and German, the following are among the best: Chaufton, *Les assurances* (Paris, 1884); Wagner, "Versicherungswesen," in Schönberg's *Handbuch der politischen Oekonomie*, ii. 2 (Tübingen, 1896-98); Emminghaus, "Versicherungswesen," "Feuerversicherung," "Lebensversicherung," in Conrad's *Handwörterbuch der Staatswissenschaften*, vi., iii. and iv. (Jena, 1890-94); Brämer, *Versicherungswesen* (Leipzig, 1894), containing a very full bibliography. The work which, when it is completed, will undoubtedly be the most erudite and exhaustive in any language, is the *Handwörterbuch des gesamten Versicherungswesens*, edited by Baumgartner, of which only the first volume has yet appeared (Strassburg, 1897-98). The annual *Cyclopedia of Insurance in the United States*, published by the Insurance Journal Company of Hartford, Conn., contains valuable digests of the insurance legislation of the various States, and of judicial decisions affecting insurance, and also descriptions of the forms of policies issued by the different life insurance companies. Ehrenzweig's *Assekuranzjahrbuch* (Vienna, 1880) gives a mass of information about insurance in the different European countries. For statistics of the United States the best source of information is the *Reports* of the Insurance Departments of the various States. Among the more valuable of these reports are those of Massachusetts, New York, and Ohio. The *Spectator Year-Book* (New York, 1869 et seq.) gives full information about fire insurance in the United States. For a theoretical treatise on fire insurance, reference may be made to Schramm-Macdonald, *Feuerversicherungswesen* (Dresden, 1883). On marine insurance, consult: Martin, *History of Lloyds and of Marine Insurance in Great Britain* (London, 1876); Gow, *Marine Insurance* (London, 1895).

INTAGLIO, ĭn-tăl′yo, *Ital. pron.* ên-tä′lyô (It., engraving, in-cutting). A term in art, the opposite of relief. (See Alto Rilievo.) It means the representation of a subject by hollowing it out in a gem or other substance, so that an impression taken from the engraving presents the appearance of a bas-relief. See Gem.

INTEGRAL CALCULUS. See Calculus.

INTEG′UMENT (Lat. *integumentum*, covering, from *integere*, to cover, from *in*, in + *tegere*, Gk. *στέγειν*, *stegein*, to cover; connected with OHG. *dah*, Ger. *Dach*, Icel. *pak*, Eng. *thatch*). The external coating or skin of animals. The term integument is also sometimes used synonymously with cell-membrane, a product of secretion which serves for the support or protection of the cell.

Lower Orders. The cell integument found in certain Infusoria consists of a chitinous or cellulose membrane, which may even harden into a shell by the impregnation of carbonate of lime. In Difflugia this membrane becomes a case by its union with small foreign particles. The integument or body epithelium (epidermis) of the Cnidaria consists of one layer of epithelial cells. These cells may be ciliated or flagellate, and in this layer occur the stinging cells or nematocysts (q.v.). These stinging cells may be grouped in masses, in which case they are known as 'stinging knobs' or stinging batteries. Moreover, in the ectoderm sensory, nerve, muscle, gland, and pigment cells may arise. In the Scolecida, a body epithelium occurs among flat-worms only in Turbellaria. It is ciliated and in it are glands, the so-called 'rods' or rhabdites. In trematodes and cestodes its place is taken by an elastic cuticular membrane, usually perforated by fine pores. In nematodes and Sagitta it is a single layer, in some species ciliated. The entire outer surface of mollusks is covered by a single layer of epithelium which may be ciliated in regions not protected by a shell. In this layer are many unicellular glands or the ducts of others that have sunk below the surface of the epithelium. The shell of mollusks is a calcified cuticle. Stinging cells may occur in the integument of gastropods, although the pigment usually occurs in the deeper cutis. The integument of cephalopods is a cylindrical epithelium, and is made up of deep-lying connective tissue which contains contracting and expanding pigment cells, the chromatophores. The integument of echinoderms consists of a unicellular epithelium, and beneath it a layer of connective tissue of mesenchymatous origin. In the latter the skeletal structures develop. In some forms (Crinoidea, Ophiuroidea), particularly in adult stages, there is no sharp line of distinction between epithelium and cutis. The epithelium is covered by a cuticle, and in Asteroidea and Echinoidea it is ciliated over the whole surface; in other forms usually the food-groove alone is ciliated. Unicellular glands and pigment cells also occur in the epithelium; while sensory cells, nerve-ganglia, and fibres differentiate out of it. The integument of annelids consists of the hypodermis or body epithelium and an outer cuticle. The latter may be thin, with pores for cilia to pass through, or it may be a thick protective covering and offer support for the attachment of muscles. It may be chitinous or even calcified into a hard shell, and is either produced by gland cells in the hypodermis or else it is a product of the metabolism of these cells. The hypodermis may be so much reduced as to be little more than a strong cuticle, as in the case of the Polyzoa, where it is hardly recognizable. A basal membrane sometimes underlies the hypodermis.

Arthropods. The chitinous secretion of the hypodermis is still more strongly developed in arthropods than in worms. It covers the whole surface of the body and appendages, and is known as the 'exoskeleton;' and to it the muscles are attached. As its presence is a barrier to the increase in size of the animal, it is thrown off from time to time, and its place is taken by a soft, flexible coating which has developed underneath it. The new coating soon hardens when exposed on the surface. See MOLTING.

Vertebrates. The integument or skin of vertebrates is an organ of much extension, but of little thickness. Physiologically it is one organ because its parts are closely united together and act together, and in most vertebrates they are easily separable from underlying tissues. The integument functions as an organ of support and protection to internal tissues, and as an organ of secretion and excretion. Morphologically it is made up of organs of widely dissimilar origin and histological character. It is divisible, however, into two layers. The outermost of the two is derived wholly from the ectoderm, and consists of an epithelium of cuboidal or flattened cells. The inner layer is derived from mesenchyme, and consists chiefly of fibrous connective tissue in which there is a large amount of secreted substance. The outermost layer is called the epidermis, the innermost the derma (or dermis); sometimes also 'corium' or 'cutis.' Each of these parts contains other organs.

Three types of epidermis may be distinguished: (1) That of Amphioxus; (2) that of fishes; and (3) that of the Amniota. The Amphibia occupy a middle ground between the second and third, in that their epidermis is at first fish-like and later similar to that of the Amniota. In the first type the epidermis consists of a single layer of cuboidal cells—the condition of the epidermis in all invertebrates. This type may be called 'unistratous.' The second and third types differ from the first and agree with each other in that they possess more than one layer of cells; hence they may be called 'multistratous.' The epidermis of fishes consists of many layers of columnar or cuboid cells, the more columnar ones lying at the base. There is a cuticule over the free surface provided with fine pore canals. From the essential similarity of the epidermal cells throughout, the epidermis cannot be divided. This type may therefore be called 'homostratous.' The epidermis of animals that live in the air (Amniota) has become modified to withstand desiccation. There may now be distinguished in man, for instance, two regions in the epidermis, a deep one composed of active cuboidal cells, and a more superficial one of flattened cornified cells. The first is known as the 'stratum mucosum,' the second as the 'stratum corneum.' These cornified cells have become such through gradual flattening of the deeper-lying cells, accompanied by a change in chemical constitution by which the cells are metamorphosed into keratin. These cells are gradually worn off, and are replaced from the layers below.

In seeking a knowledge of the origin of the many-layered epidermis we must study the comparative ontogenetic and phylogenetic development of epidermis. At the time of gastrulation the ectoderm of mammals, from which alone the epidermis is derived, is unistratous. In this condition it is like the epidermis of all invertebrates. In this condition, too, it persists in Amphioxus to an adult stage. Quite early in the embryonic development of mammals, however, the nuclei arrange themselves in two layers as though forced to do so by pressure. Such a condition prevails in the human embryo of two months. (See EMBRYOLOGY, HUMAN.) The more superficial layer consists of flattened, transparent, hexagonal elements—the deeper layer of smaller cells; so that already a separation into a 'stratum corneum' and 'stratum mucosum' has appeared. This partly differentiated condition of the epidermis occurs in the amphibian larvæ. In the adult Amphibia the epidermis may become many-layered. The outer layer is cast from time to time in one piece in Amphibia and Reptilia. In birds and mammals the cornified cells are being constantly shed. In Amphioxus and fishes the epidermis is provided with a cuticula, while in some larval forms and in certain regions of adults it is ciliated. The epidermis is separated from the cutis by a basement membrane.

Types of Derma. The derma is composed of connective tissue and is derived from mesenchyme. This is a more compact layer than the looser subdermal tissue that lies still deeper. Three types of derma may be distinguished: (1) That of Amphioxus, consisting of a layer of flat cells, together with a gelatinous substance which they have secreted from their outer surfaces; (2) that of fishes and amphibians, in which the bundles of connective tissue run in two directions, parallel and perpendicular to the surface; (3) that of birds and mammals, in which the above described distribution of connective tissue bundles is lost, and the boundary between derma and epidermis is no longer straight, but strongly corrugated. The derma sends up projections or papillæ into the epidermis. The derma of man belongs to this type, but in its ontogenetic development it passes through stages much resembling the first two.

Within the integument various structures are differentiated, such as pigment in granules or specialized cells; glands, both unicellular and multicellular—scutes or scales of reptiles, feathers of birds, hair, nails, hoofs, and claws; and dermal bones and teeth.

Dermal bones and teeth of higher vertebrates have probably been derived from the dermal bones or bony scales and the tooth-structures of fishes. Neither Amphioxus nor cyclostomes possess any trace of an exoskeleton. Longitudinal and transverse rows of small denticles are present in selachians. Each denticle consists of a basal plate and a spine. The dentine of this scale is formed by the mesoderm, while the ectoderm forms the enamel which covers the denticle. The first impulse toward tooth-formation seems to reside in the derma. The teeth of fishes are fused with the tooth-cement. The teeth of some reptiles lie in sockets in the bone. The teeth of selachians lie in several rows upon the upper and lower jaws. Only one or two of these rows are functional at a time. The outer rows are replaced from time to time by the younger and inner rows. In mammals the process of replacement of teeth is limited in most cases to one occurrence, and the number of teeth is also limited. The gap in the number of teeth in selachians and mammals is bridged by the gradual reduction occurring in intermediate forms. Between scales and the teeth of selachians also intermediate forms occur. The dermal bones such as occur in the vertebrate skull, or in the pectoral arch of fishes, are homologous with the basal plates of the dermal denticles of selachians. They are probably formed by a fusion of such plates. The dermal skeleton is phylogenetically older than the endoskeleton, but it tends gradually to disappear the higher we ascend in the animal scale.

Consult: Wiedersheim, *Comparative Anatomy of Vertebrates* (Eng. trans., 3d ed., Jena, 1893); Lang, *Text-Book of Comparative Anatomy* (London, 1891-96).

INTEGUMENT (in plants). A general term, but technically applied in seed-plants to the specially developed coat of the ovule. The integument is never absolutely complete, as it leaves at the apex of the ovule a small opening through which the pollen-tube enters, known as the 'micropyle,' and at the opposite end of the ovule (chalaza) it is not distinguishable as a layer. In many cases an ovule has two integuments. See OVULE.

INTELLECT (Lat. *intellectus*, understanding, from *intellegere*, *intelligere*, to perceive, from *inter*, between + *legere*, to choose, gather). The common name for the mental processes concerned in the function of cognition. It is thus the counterpart of feeling and will. (See these titles, and AFFECTION.) In the older psychology, a distinction was drawn, in various ways, between 'higher' and 'lower' forms of cognition (see FACULTY), and intellect was thus marked off from sense, or from sense and imagination. "There is nothing in the intellect that has not previously been in sense," says Descartes; but Leibnitz adds, "except the intellect itself." Kant's 'pure intellect' is, similarly, an intellect freed in its operation from the intermixture of sense. In modern terminology, intellect covers both sensation and its derivatives; so that its treatment includes the study of the formation of perception and idea, the association of ideas, memory and recognition, passive and active imagination, and reasoning. The word 'intellection' is sometimes reserved for the formation of concepts and judgments and for reasoning; see the discussion of these processes under LOGIC.

The root-function in intellect is discrimination (see DISCRIMINATION, SENSIBLE), which implies knowledge of the likeness of similar and of the difference of dissimilar things, and (in the case of man) capacity to report in language upon this likeness and difference. The discriminative function is supported and extended by that of reproduction (see MEMORY), which adds a past and a future to the present domain of mind. Discrimination and reproduction have been variously subdivided, both upon a genetic and upon a logical basis. Classifications of the latter kind are, however, merely aids to the presentation of psychology, and do not themselves contribute to our knowledge of mind; while genetic classifications have so far rested rather upon the logic of some psychological system, or upon biological analogies, than upon unbiased observation of the developing organism. Consult: Bain, *The Senses and the Intellect* (London, 1868); Sully, *Human Mind* (London, 1892); Ladd, *Psychology: Descriptive and Explanatory* (New York, 1894); Titchener, *Outline of Psychology* (New York, 1899). See ANIMAL PSYCHOLOGY; GENETIC PSYCHOLOGY.

INTELLECTUALISM (from *intellectual*, from Lat. *intellectualis*, pertaining to the understanding, from *intellectus*, understanding). The philosophical theory that the intellect, rather than the affections or the will, is the fundamental process of consciousness, and therefore, on an idealistic interpretation of reality, the ultimate basis and support of all existence. It stands opposed to voluntaryism and to certain forms of mysticism (q.v.) which emphasize the epistemological and metaphysical importance of the affections.

INTEMPERANCE. See ALCOHOLISM; INTOXICATION; DRUNKENNESS; TEMPERANCE.

INTENSITY OF SENSATION (from Lat. *intensus*, p.p. of *intendere*, to stretch out, from *in*, in + *tendere*, to stretch, Gk. *τείνειν*, *teinein*, Skt. *tan*, to stretch). One of the four attributes of sensation, the others being quality, extent, and duration. The intensive aspect of sensation is that "property which enables us to compare it with others in respect to vividness" (Kuelpe). Theoretically every sensation must possess a certain intensity in order to enter consciousness. In the sphere of vision, however, there exist certain facts which make it advisable, according to some psychologists, to eliminate the attribute of intensity. Variation of the amplitude of vibration of the stimulus acting upon the retina effects a variation not only in the luminosity, but also, under most conditions, in the color-tone and the saturation of the correlated sensation. Here, then, intensity seems reducible to quality. This is the position of Hering and Hillebrand. On the other hand, König maintains that there are two places in the spectrum (the one in the red and the other in the violet) where this does not hold true. G. E. Müller has, furthermore, sought to overcome the difficulty by defining intensity as degree, the distance of a sensation from the zero-point (apart from qualitative change). If two colors are both reduced, that which reaches the zero-point first has the less intensity. If we add to or subtract from the brightness of a given color quality, we change its intensity, but we do not interpret the alteration simply as a change in intensity, because there is always in operation a centrally excited sensation of gray. (See VISUAL SENSATION.) If we could change the intensity of a color-tone without having this central process in operation, the change would be correctly noted as intensive only.

The main problems of intensity are two: (1) That of the minimal intensity of sensation, and (2) that of the change in intensity of stimulus which is just noticeable in sensation. There must be, accordingly, a determination for each sense department of the intensive limen (q.v.), and of the intensive sensible discrimination. The importance of these problems is attested by the fact that all the classics of the science of psychophysics (q.v.) have been concerned with the relation obtaining between intensity of stimulus and intensity of sensation rather than with the more intricate dependencies between the other attributes of stimulus and sensation.

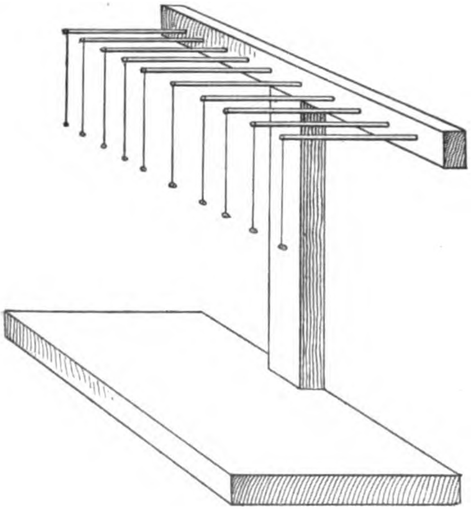

FIG. 1. FORM OF SCRIPTURE'S APPARATUS FOR TESTING SENSITIVITY TO TOUCH.

The rack bears rods with cork pellets of different weights depending from them. The weight of the lightest of these cannot be felt on the hand by the normal subject.

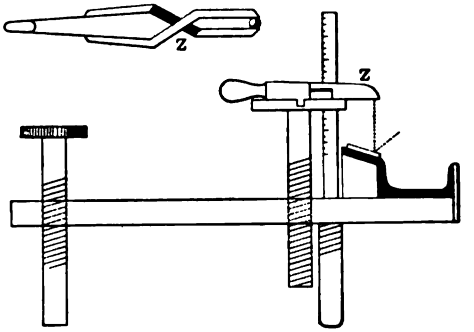

FIG. 2. LEHMANN'S APPARATUS FOR DETERMINING THE LIMEN OF SOUND INTENSITY.

The forceps Z containing a leaden ball is placed on the head of a millimeter screw. The ball is released by pressure of the forceps and falls, along the dotted line, on the slanting surface, which is covered with cloth and on which is laid a glass or copper plate. The height of the fall regulates accurately the objective intensity of the sound stimulus.

The liminal intensity of *pressure* depends upon the place stimulated. With cork pellets as weights, it has been found to be 2 mg. upon the forehead. nose, and cheeks; 5 mg. upon the lips, upper arm, and nape of the neck; 10 mg. upon the fingers; and 1 g. on the nails. By stimulating individual pressure spots with fine hairs, Von Frey obtained much lower values, averaging, for the calf 1.44 gr. mm., and for the wrist 1.28 gr. mm. (where gr. denotes the pressure exerted by the hair, and mm. denotes the radius of its cross-section). The *pain* limen, as recorded by the hair method, gives the following values in gr/mm^2, where mm^2 denotes the area of the cross-section of the hair: over the epicondyle of the humerus, 30; over the radius, 20; over the knee-pan, 49; over the olecranon of the ulna, 40; on the conjunctiva of the eye, 2 to 7. On account of the variation of the actual temperature of the skin, or the 'physiological zero-point,' the examination of the intensive sensibility of *temperature* sensations exhibits peculiar difficulties. We can merely say that the sensitivity for cold is greater than that for warmth; that the sensitivity is greater over the lateral surfaces of the body than in the median plane; and that, as a rule, it increases from the periphery toward the trunk. The liminal intensity for *taste* depends not only on the concentration of the solution, but also on the area stimulated, the amount of movement within the buccal cavity, and the general condition of excitability of the taste nerves prevailing at the time. Furthermore, the tip of the tongue is most sensitive to sweet, the base to bitter, the sides to sour, and the body to salt. The average limina have been found to be represented by the following figures, based upon a solution in 100 parts of distilled water: salt, 0.24; saccharine, 0.49; hydrochloric acid, 0.0063; sulphate of quinine, 0.00005. The intensity of *olfactory* sensations is likewise dependent upon the rate and manner of breathing, the rate of diffusion of the odorous vapor, and the general conditions of the smell organs, as well as upon the amount of saturation of the air with the minute particles of the odorous substance. Current figures show that the limen is very low for some qualities; e.g. musk, 1/200000 mg.; sulphureted hydrogen, 1/5000 mg.; bromine, 1/600 mg. In *audition*, the existence of absolute silence is to be doubted. Most authorities agree that we can never get free from the noises caused by the pumping of the blood through the ears. Closing the ears, or standing with open ears near any reflecting surface, only intensifies the sound. The liminal intensity for *noise* may, then, be regarded as that intensity which is just perceptible above this internal sound. A cork pellet weighing 1 mg. and falling through 1 mm. upon a glass plate can just be heard at 91 mm. from the ear. A *tone* from a pipe giving 181 vs. per second is audible when the air-particles set in motion by it possess an amplitude of excursion of only 0.00004 mm., and the mechanical work done by it upon the ear is one three-billionth kilogram-meter. Other investigations have placed the latter value as low as 0.0022 mg.-mm. The sensitivity for high tones is in general greater than that for low tones. The investigation of the *brightness* limen reveals a difficulty analogous to that cited in connection with the auditory limen. The existence of the 'idio-retinal light' precludes absolute sightlessness, as the 'idio-aural noise' precludes absolute silence. For external stimulation, the brightness limen may be put at the illumination of black velvet by a stearin candle nine meters distant. It is sometimes estimated (though too high) at 1/300 the light of the full moon. In one-half second this light exerts upon the retina the energy required to raise 1/15 mg. of water one billionth of a degree C. For the liminal sensitivity to *articular* sensations, see MOVEMENT, PERCEPTION OF.

The investigations of the intensive sensible discrimination are included under Weber's law, a proposition which may be stated thus: the ratio of the increment of stimulus, necessary to give a noticeably different sensation, to the existing stimulus is constant. The problem is, then, to discover whether this principle of the constancy of the relative difference limen is applicable to each sense department, and to ascertain the numerical value of the constant in those departments in which its applicability is established. E. H. Weber himself determined the constants for *pressure* as follows: with simultaneous application of the weights to both hands, 1/3; with successive applications to the same hand, 1/14 to 1/30; with simultaneously lifted weights (involving both pressure and strain sensations) 1/15 to 1/20; with weights lifted successively with one hand, 1/40. These figures have been modified by subsequent investigators, notably G. T. Fechner, J. Merkel, and recently L. Martin and G. E. Müller (in an extended qualitative analysis of the conditions of such tests). The discriminability of *temperature* intensities varies with the part of the body tested, and especially, it seems, with the thickness of the epidermis. Fechner's constant is 1.8° C., E. H. Weber's 1.4° to 1.5° C. The region of finest discrimination seems to be that between 26° and 33° C. Cooling is noted sooner than warming, in the proportion of three to two. Of *taste*, little is known save that Weber's law holds approximately for bitter and salt. The phenomenon of 'taste contrast' is a source of unavoidable disturbance in this field. A careful survey of the olfactory sense has confirmed the applicability of Weber's law to *smell*, and established the constant at 1/3 with 36 per cent. of the substances tested, and at 1/4 for 26 per cent. Most successful results are those obtained in audition. The relative sensible discrimination for *noise*, tested by the fall phonometer or the sound pendulum, remains constant at 1/3 within a wide range of intensities. Technical difficulties impede the observation of *tones*, but enough has been done to show that, at least within the central part of the scale, variations in tonal intensity follow the law. Work in *brightness* is subject to many sources of error—difficulties in securing standard conditions of adaptation, accommodation, etc. The many investigations which have been completed do not, therefore, concur as to the constant, which is variously estimated at 1/60, 1/100, 1/120 to 1/230. The value 1/110 may be assumed as approximately correct. Of interest in this connection is the apparatus which can be employed to demonstrate the existence of the constancy or to indicate its numerical value. 'Masson's disks' are white disks, on one radius of which a number of heavy black sections are marked. Upon rapid revolution there is produced a series of concentric gray rings decreasing in darkness toward a periphery. The same ring remains, within certain limits, just visibly gray when the illumination is changed.

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INTENT (Lat. *intentus*, purpose, from *intendere*, to stretch, intend, from *in*, in + *tendere*, to stretch; connected with Gk. τείνειν, *teinein*, Skt. *tan*, to stretch, and ultimately with Eng. *thin*). As employed in law, the purpose or design with which an act is done. Ordinarily the legal consequences which flow from acts are entirely independent of the intent or motive with which the acts are performed. This is true of all violations of the general rights, known as rights *in rem*, more commonly described as property and personal rights. Thus the right to be free from trespass and the right to be secure from violence or from arbitrary arrest do not depend in the least on the motive or intent of the person violating them. It is only in those cases in which the rights claimed flow from the engagements of a party, or in which the law has, from motives of its own, attached consequences to the intent with which an act is performed, that intent acquires any legal significance. Obviously any rights claimed under a will, a deed, or a contract flow from the intent of the person executing it, and, in certain classes of torts, a malicious or fraudulent motive may constitute the gravamen of the offense complained of.

But, in all of these cases, it is not the actual and secret motive, but the expressed intent which determines the legal character of the act in question. This is the real meaning of the rule which forbids the introduction of parol evidence to contradict or vary the terms of a written instrument. The grantor of land is not permitted to show that he intended to convey another and different parcel of land. He must stand by the intent as expressed in his deed. So, in a will, a legacy to A cannot, by proof of a contrary intention on the testator's part, be converted into a gift to B, nor can one who has sold a horse for $100 show that he intended to charge $150 for the animal. Analogous to this principle is the rule applied in those wrongs in which intent is an element, as in malicious mischief and certain cases of defamation and negligence. The person committing the injury is held to have intended the reasonable and probable consequences of his acts, and cannot exonerate himself from liability by showing that his intention was really of an innocent or benevolent character.

There are other classes of cases, however, in which the actual intent with which an act was performed is a proper matter for judicial inquiry. This is especially so in cases where the wrongful intent is the gist of the wrong, as in actions for deceit, and, under certain circumstances, in proceedings to set aside fraudulent conveyances. See DECEIT; FRAUDULENT CONVEYANCE; INTERPRETATION; SALES; and the authorities there referred to.

IN′TERAM′NA. The ancient name of Terni (q.v.), Italy.

INTER′CALARY. A supplementary day or month. See CALENDAR; BISSEXTILE; LEAP-YEAR.

IN′TERCEL′LULAR SYSTEM (from Lat. *inter*, between + Neo-Lat. *cellula*, *cellule*, diminutive of Lat. *cella*, cell). The system of spaces in plants, often continuous, between the cells. They may be formed by the splitting of cell-walls (schizogenously) or by the breaking down of masses of tissue (lysigenously). Spaces formed by splitting are found only in the higher plants, and do not occur at all in plants below the mosses. When a tissue is very young, its cells are angular and in such close contact that there are no intercellular spaces; but as the cells grow older they may become rounded, and the common walls may split at the angles, thus producing intercellular spaces of various extent. When the spaces are very large, as in the stems of water-lilies (Nymphæa), they are called 'air-chambers.' Smaller intercellular spaces are almost universal in the spongy parenchyma of leaves, in the pith of stems, and in older parenchyma generally. To this category belong many glandular passageways, like the resin-ducts of conifers, the mucilage-ducts of cycads, the gum-resin ducts of the umbellifers, etc. Spaces formed by the breaking down of masses of tissue give rise to the hollow stems of grasses and many other plants. The cavities in the leaves of quillworts (Isoetes) and many other plants are also formed in this way. The oil-glands of the orange and lemon, many glands on leaves which appear to the naked eye as 'pellucid dots,' the gum-cavities in the tissues of cherry-trees, are all examples of lysigenously formed glands. See ANATOMY OF PLANTS; AËRATION.

INTERCESSION, DOCTRINE OF (Lat. *intercessio*, from *intercedere*, to intervene, from *inter*, between + *cedere*, to go). A doctrine of theology, based on certain passages of Scripture which are held to represent Christ, after having finished His redemptive work on earth, and ascended into His state of glory and exaltation, as ever pleading with God on behalf of those whom He has redeemed by the shedding of His blood (Rom. viii. 34; Heb. vii. 25; I. John i.). It is not to be supposed, however, that God needs to be interceded with, as if He were still reluctant to forgive men, or that Christ's intercession makes Him more merciful than before. The intercessory work of Christ is to be regarded rather as intended to make eternally individual application of the sacrifice of atonement to believers. The doctrine of the intercession of Christ is held alike by Protestants and Roman Catholics; but the latter, in addition, believe in the efficacy of the intercession of the Virgin and the saints, on which see SAINTS.

INTERCOLUMNIATION (from Lat. *intercolumnium*, space between two columns, from *inter*, between + *columna*, column). In classic architecture, the distance between the columns of a building, measured at the bottom of the shaft. The intercolumniation varies in different examples, and among the Greeks seems to have been determined by the taste and the general scheme of proportions adopted for the building rather than by fixed rules. It may vary from one and a half diameters of the column to over three. An intercolumniation of two and one-quarter diameters is called *enstyle* by Vitruvius, and regarded as the most appropriate. The central intercolumniation of a colonnade is frequently made wider than the others when required for access to a gate or door.

INTERDICT (Lat. *interdictum*, prohibition, from *interdicere*, to forbid, from *inter*, between + *dicere*, to say, Gk. δεικνύναι, *deiknynai*, Skt. *diś*, to point out; connected with Goth. *gateihan*, to tell, OHG. *zīhan*, Ger. *zeihen*, AS. *tēon*, to accuse). An ecclesiastical censure or penalty in the Roman Catholic Church, which deprives the faithful of certain sacraments (q.v.), of participation in the celebration of the divine offices, and of ecclesiastical burial. Interdicts are of three kinds—personal, local, and mixed. When the censure affects only some designated individuals, it is called a particular personal interdict. When it affects a whole community or corporation, it is called a general personal interdict. A local interdict affects only such individuals as are present in a designated place, and can be avoided by removing from the place. A particular local interdict affects only a single monastery, church, or seminary. A general local interdict applies to an entire parish, city, province, or kingdom. In such general censures, certain churches are usually excepted. Lastly, mixed interdicts affect both a locality and all its inhabitants wherever they may go, or a person and any place in which he or she may be. The last is called an ambulatory interdict. The principle on which this ecclesiastical penalty is founded may be traced in the early discipline of public penance, by which penitents were for a time debarred from the sacraments, and from the privilege of presence at the celebration of the Eucharist. It grew out of excommunication (q.v.), and at first was called a general excommunication. Then it usually deprived the persons who dwelt in the excommunicated place of all sacraments. From 375 on, there are instances of such general excommunications. But the interdict proper took its peculiar form, although not its name, in Northern France in the ninth century. It was adopted by the Popes about the middle of the eleventh century, and the term interdict was used in its technical meaning in 1062. It came into use as an ordinary Church censure in the frequent conflicts of the ecclesiastical and civil power. It was designed to awaken the popular conscience to the nature of the crime, by including all alike in the penalty with which it was visited. In this way public pressure could be brought upon the rulers who had offended. The most famous interdicts are those laid upon England in 1171 by Alexander III. after the murder of Thomas à Becket (q.v.); upon Scotland in 1180 by Alexander III.; on France, under Philip Augustus, by Innocent III., in 1200 (although some historians deny that any interdict was then laid); and on England under John, in 1209. The description of England under the last-named interdict, as detailed by some of the contemporary chroniclers, presents a striking picture of the condition of a country where the interdict was strictly obeyed. It would be a great mistake, however, to suppose that during the continuance of an interdict the people were entirely destitute of spiritual assistance. The severity had been greatly lessened by the middle of the eleventh century; it was permitted to administer baptism, confirmation, penance, and the Eucharist in all cases of urgency; privately to confess and absolve all who were not personally the guilty participators in the crime which the interdict was meant to punish; to celebrate marriage, with only the witnesses present; and to confer orders in cases of necessity. Gregory IX. allowed mass to be said once a week, behind closed doors, in order to consecrate the host for the use of the sick; Boniface VIII. permitted the offices to be said in the churches, but the laity were to be excluded; public celebration of services were allowed on Christmas, Easter, Pentecost, the Assumption of the Blessed Virgin, the festival of Corpus Christi, the festival of the Conception, and a few other occasions. The Council of Basel enacted very stringent rules as to the use of this penalty, and in later times the general interdict has been entirely disused. The interdict on Venice in 1606 is often cited as the last one pronounced, but occasionally, in very special circumstances, and to mark the horror of the Church for some enormous crime, instances are still recorded in which a particular place or church has been visited with the penalty of a local interdict. Interdict differs from *excommunication*, in that those under the censure are not given over to eternal damnation. It differs also from *suspension*, which applies only to ecclesiastics.

Consult the existing regulations on the subject in Aichner, *Compendium Juris Ecclesiastici* (Brixen, 1900); Laemmer, *Institutionen des katholischen Kirchenrechts* (Freiburg, 2d ed. 1892). Also: De Ligorio, *Thelogia Moralis*, vol. vii., 251 (Paris, 1834); Ducange, *Glossarium*, under "Interdictum."

INTERDICT. In the civil law, a judicial process analogous to the injunction of English and American law. In its earliest form in Roman law it was a peremptory decree of the prætor, restraining any interference with property the right to the possession whereof was in dispute. It seems still, in the modern civil law, to be restricted to prohibitions as to the possession of property, though in Scotland the term is applied to any process of the Court of Session restraining the performance of any unlawful act. An interdict is not, however, limited to the prohibition of contemplated acts, but may also be employed to compel the restitution of property of which a person entitled to possession has been forcibly deprived, and to compel the presentation, or 'exhibition,' of an account. Interdicts are accordingly classified, according to the purpose sought to be effected, as prohibitory, restitutory, and exhibitory. Consult the authorities referred to under Civil Law; and Erskine, *Institute of the Law of Scotland.*

INTERDICTION. A process of the civil law employed for the purpose of depriving a person who is *non compos mentis* of the control of his property, and, on occasion, of other civil rights. The process is analogous to the inquisition in lunacy (q.v.) of English and American law, whereby the incapacity of a person to manage his own affairs may be inquired into, and the management of his interests committed to a guardian or trustee. The jurisdiction thus exercised is as old as the Twelve Tables, but it was originally employed only to restrain prodigals from dissipating their estates. By modern codes, it is generally confined to cases of imbecility and lunacy; but this is not the case in the French code. In the case of imbecility and lunacy interdiction may be only partial, the interdicted person being forbidden to sue, to borrow, to pledge or hypothecate his property, or to make any conveyances, without the consent of the court; or it may be complete, in which case a guardian or curator is appointed, and the management of the affairs of the interdicted person committed to him. The practice in Scotland, Louisiana, and Quebec is substantially the same as in the Continental States, whose legal systems are borrowed from that of Rome. Consult the authorities referred to under Civil Law; also Erskine, *Institutes of the Laws of Scotland.*

INTERES'SE TER'MINI (ML., interest in a term). At the common law, the interest which a tenant for years has in the lands leased to him, before he has entered upon them. The lease is regarded as conferring only an inchoate title or estate, which requires an entry by the tenant to perfect it. But though the *interesse termini* falls short of being a complete leasehold estate, it is yet more than a mere chose in action (q.v.) or right of entry (q.v.). It is a true interest or estate, a right *in rem* (q.v.), capable of alienation and of transmission upon the death of the tenant to his personal representatives, and generally in the United States the same statutory remedies are available as in case of the perfected estate. See Lease; Leasehold.

INTEREST (OF. *interest*, Fr. *intérêt*, interest, from Lat. *interest*, it concerns, 3d pers. sg. pres. ind. of *interesse*, to concern, from *inter*, between + *esse*, to be). A certain profit or premium for the use, forbearance, or detention of money. In spite of the natural feeling that the payment of interest was a hardship, and that to exact interest from a borrower was to take an unfair advantage of his necessities, all the chief peoples of antiquity recognized that interest might lawfully be stipulated in connection with a loan, and might be awarded in the discretion of the court even when no such stipulation had been made. Babylonian tablets show ordinary loans at moderate interest, and also maritime loans, in which the claim of the creditor for his principal was extinguished by the loss of the ship, and on which a much higher rate of interest was exacted. It was very common among the ancient Hebrews, and the Mosaic law contains a prohibition against the taking of usury (or interest, as it should have been translated) from the Jews, but permitted it as to all other races. The Greek and the Roman laws recognized interest. The Romans called it payment for use (*usuræ*), and assimilated it to the natural yield or increase derived from organic nature by classing it, with rent, among civil or legal fruits (*fructus civiles*). They did not limit it to the loan of money exclusively: any generic or 'fungible' things, like wheat, wine, or oil, could be stipulated.

Aristotle speaks of it, but condemns it as vicious, holding that money is 'naturally barren,' and that to make it 'breed money' is preposterous and a perversion of the end of its institution, which, he declared, was to serve as a medium of exchange and not for purposes of increase. Through a misconstruction of the real intent and purpose of the law of Moses, which was clearly a political and not a moral precept, and following the curiously narrow philosophy of Aristotle on this subject, the Christian Church and laymen early condemned the custom, and held any interest to be usury and against good morals. The secular law in Christian nations naturally followed the ecclesiastical in those times, and the taking of interest was forbidden in England from the reign of King Alfred in the ninth century to the time of Henry VIII. The prohibition of interest led, of course, to many evasions; and to one of the most ingenious and successful of these the word 'interest' owes its modern technical meaning. At Roman law, interest (*quod actoris interest*, the difference to the plaintiff) meant damages. The Church itself did not deny that one from whom money was wrongfully withheld was entitled to damages. Contracts for the repayment of money loaned were accordingly so drawn as to insure a technical default on the part of the borrower, and the damages to be paid on default were stipulated in advance. The prohibition of interest led also to the development of new legal institutions like the *commandita*, or silent partnership, in which payment for the use of money took the form of a share of profits. The prohibition of interest was generally rescinded by secular legislation before or at the close of the Middle Ages; in Germany, however, not until 1577. By the statute of 37 Henry VIII., ch. ix., in 1545, interest to the amount of 10 per cent. per annum was permitted. This was accomplished in a negative manner, by simply providing penalties for taking more than that amount, thus giving only an indirect sanction to taking it at all. By statute of 12 Anne II., ch. xvi., 5 per cent. was fixed as the maximum amount of interest which could be demanded. In the United States the demand of interest on money due has always been recognized as just. However, the right to interest exists only by virtue of such statutes or by agreement of parties, and does not follow necessarily as a legal right from the mere fact that one has another's money in his possession, or owes him money by contract. For example, in the absence of statute or agreement, if A loans B $100 to be paid on demand, A may demand payment five years hence, but is not entitled to interest for that time. And even under such statutes interest does not begin to accrue until money is due and payable, because not until that time is there an unjust detention from the owner. Previous to the debt becoming due, the matter is, in contemplation of law, regulated by agreement of the parties.

The statutes in most jurisdictions provide that interest shall be allowed at a fixed rate on all sums when they become due, as on a debt for goods sold and delivered when the period of credit has expired. It is not customary, however, to exact interest in such cases unless the creditor is forced to sue on his claim. In some States, and in England, interest is allowed in certain tort actions on the amount of the damages awarded from the time the claim accrued, but this is not the general rule.

A distinction is usually made between the rate which will be allowed by law, usually called the 'legal rate,' where it is not agreed upon by the parties, or where allowed by operation of law, as on a judgment, and the maximum rate which may be stipulated for by contract, sometimes known as the conventional rate. For example, in Ohio the statutes provide that 6 per cent. shall be allowed on all sums on which interest is chargeable by operation of law, as on a judgment after its entry, and on sums due where no rate is agreed upon by the parties, whereas 8 per cent. may be legally demanded if provided for by express contract.

The following are the rates of interest fixed by law in the States and Territories of the United States:

STATES AND TERRITORIES	Legal rate per cent.	Rate allowed by contract per cent.
Alabama	8	8
Arizona	6	any
Arkansas	6	10
California	6	any
Colorado	8	"
Connecticut	6	"
Delaware	6	6
District of Columbia	6	10
Florida	8	10
Georgia	7	8
Idaho	7	12
Illinois	5	7
Indiana	6	8
Iowa	6	8
Kansas	6	10
Kentucky	6	6
Louisiana	5	8
Maine	6	any
Maryland	6	6
Massachusetts	6	any
Michigan	5	7
Minnesota	6	10
Mississippi	6	10
Missouri	6	8
Montana	7	12
Nebraska	8	8
Nevada	7	any
New Hampshire	6	6
New Jersey	6	6
New Mexico	6	12
New York	6	6
North Carolina	6	6
North Dakota	6	12
Ohio	6	8
Oklahoma	7	12
Oregon	8	10
Pennsylvania	6	6
Rhode Island	6	any
South Carolina	7	8
South Dakota	7	12
Tennessee	6	any
Texas	8	10
Utah	8	any
Vermont	6	6
Virginia	6	6
Washington	6	12
West Virginia	6	6
Wisconsin	7	10
Wyoming	8	12

These rates are occasionally changed by statute, but there has been comparatively little variation in recent years. An interesting fact is that several Eastern States, as Massachusetts, have removed all limitations on rates by contract, and in New York any rate may be charged by contract on loans exceeding $5000 payable on demand, and known to the financial world as 'call loans.'

In Great Britain, after the existence of rigorous measures against excessive interest for centuries, all statutes against usury and fixing rates of interest were repealed by the act of 17 and 18 Vict., ch. xc. (1854). The power of the court of equity to relieve against unconscionable bargains as to interest still exists; and in 1900, by the Money Lenders' Act, special provision was made for setting aside a contract made with a professional lender of money where an oppressive rate of interest is charged. In France the legal rate is 5 per cent., but more may be demanded by contract.

The usual method of calculating interest is to compute it on the principal sum originally due for the period which has elapsed at the time of computation, but by agreement compound interest may be allowed; that is, the arrears of interest for each year are added to the principal sum, and interest for the following year is computed on this accumulation, and so on, thus giving the investor interest upon interest. It is customary to compute interest in this manner upon deposits in savings institutions.

In popular usage, interest is the payment made by a borrower for the use of a sum of wealth for a definite period of time; it is expressed as the ratio which that payment bears to the value of the wealth loaned—the 'principal.' In economic theory the term interest is used in a broader sense, and signifies the return for the use of capital, whether the employment of capital is made directly by its owner or by another person to whom it has been loaned. In the latter instance it appears as a sum paid by the borrower over and above the amount received in loan. It is calculated at a certain percentage of the capital to be paid annually. Economists distinguish from interest that part of the gross product which is necessary to replace the original capital, and the extra return to capital which appears in enterprises involving risk of loss, as well as chance gains and the abnormal return due to superior management. The last three forms of income are usually classed under the head of profits (q.v.).

Loan or contract interest may be paid for wealth for immediate consumption as well as for wealth which is employed as capital. In the earlier stages of industrial development, when little capital was used, loans normally assumed the former character. Money was loaned to those persons who were in temporary distress, or to spendthrifts who desired to anticipate future revenues. In either case the repayment of the principal was a hardship, and the additional payment of interest, usually calculated at a high rate because of uncertainty of repayment or because of the necessities of the borrower, was peculiarly vexatious. For these reasons the taking of interest was generally condemned by public sentiment, and frequently penalized by legislators. (See USURY.) This was the case in ancient and mediæval nations; and much the same attitude survives in backward communities of the present day. With the development of capitalistic production, the gain to the borrower who invests the wealth borrowed in productive enterprise became so obvious that the opposition to interest declined, and no longer exists among business men.

In competitive industry there is a close connection between loan interest and the return to capital. It is obvious that the explanation of loan interest lies in the fact that had the owner of the capital employed it himself he could have secured a return from its use. When he turns it over to some one else he foregoes this return and must be compensated for it. It is immaterial whether the lender would have used his capital in productive enterprise or whether the borrower does so. The fact that it might be so used establishes a claim for compensation. Such an explanation does not make it clear why the owner of capital secures a return for its use, but admitting that in the present economic order he does so, it explains why the borrower pays interest upon a loan. It also serves to indicate certain limits upon the rates of interest under normal circumstances. Lenders cannot demand more, nor can borrowers expect to pay less than the return normally expected from the employment of capital in productive industry.

Explanation of the phenomena of interest must be sought in the laws which make it possible for capital to produce a net return. A large number of theories have been advanced to explain the existence of net return to capital. (See POLITICAL ECONOMY.) We may notice here three theories which have attained the largest following: (1) The *abstinence* theory, which regards interest as a reward for the abstinence which the capitalist exercises in employing his wealth for productive purposes instead of consuming it unproductively; (2) the *productivity* theory, which lays emphasis upon the fact that capital represents an instrument which greatly increases the efficiency of labor, and therefore normally entitles its owner to a reward; and (3) the *exploitation* theory, which regards labor as the sole source of wealth, the income known as interest being merely a tribute to the capitalists who hold a monopoly of the opportunities for employment.

In recent economics a variety of the abstinence theory has gained a large following under the leadership of Professor Böhm-Bawerk, who explains interest as a result of the universal undervaluation of future goods as compared with present goods. The productivity theory finds its foremost champion in Prof. J. B. Clark. In his view, capital, as a limited agent capable of increasing the output of industry, is productive in the same sense in which labor is productive; and the measure of this productivity is the loss to industry which would result if the least important portion of capital were withdrawn. In explaining the laws which govern interest, Prof. Alfred Marshall and his followers take a position midway between the productivity and abstinence schools. The rate of interest depends upon the relations between the demand and the supply of capital. The demand for capital varies with the opportunity for its productive employment; the supply varies with the readiness of individuals to postpone consumption to a future date. If productivity is high, the inducement to save is correspondingly great; and consequently the supply of capital increases. With increase in supply of capital, its productivity declines, until no reason exists for further creation of capital. The rate of interest, therefore, tends to become fixed at the point where the productivity of capital is just sufficient to compensate those who save for the disadvantages which attend the postponing of consumption, or 'waiting.'

BIBLIOGRAPHY. Böhm-Bawerk, *Capital and Interest*, translated by Smart (London, 1890); id., *Positive Theory of Capital*, translated by Smart (London, 1891); Marx, *Capital*, translated (London, 1887); Clark, *The Distribution of Wealth* (New York, 1899); Marshall, *Principles of Economics* (3d ed., London, 1895). Consult also the authorities referred to under CONTRACT; USURY.

INTEREST (in psychology). Employed in a very wide sense, the influence which objects exert over the attention. An unusual sound interests us, and at the same time attracts our attention. In such a case it is not correct to say that 'we attend *because* we are interested,' if by this we mean that the interest precedes the attention. In strictness, we are interested in a particular object or line of thought only *while* we are attending to it. Interest is, then, one aspect of attention. It is the feeling aspect. To be interested is to have ideas which 'feel.' Hence, an object interests us when it affects us pleasantly or unpleasantly; though it is more usual to include among interesting objects only those which cause pleasurable feeling. This explains the fact that, although attention and interest are, in part, identical, interest serves to prolong the state of attention. If an impression affects us pleasantly, we tend to retain it in mind, it 'holds the attention.' This is true to the extent that the greatest voluntary effort to attend may result in failure, unless an intrinsic interest springs up with the state of attention.

The incentives to the arousal of interest are the same as the conditions governing attention (q.v.). The objective conditions include novelty, intensity, duration, movement, and the 'vital' importance of certain impressions (an animal is fascinated by its enemies and its prey; a man is interested in his kind). The subjective conditions of interest depend upon mental constitution (q.v.). The 'born mechanician' is always interested in machinery and the professional man is interested in whatever pertains to his profession. Interest is most easily aroused where an object has many relations to past experience; i.e. where it can be brought into contact with knowledge already acquired. The reason is that the feeling which is the essential part of interest is awakened through the processes of assimilation and through the mood of familiarity (q.v.). This fact is of importance in education. The child cannot learn things entirely new, but only such things as extend and modify his present stock of ideas and feelings. (See APPERCEPTION.) Nevertheless, a correct theory of education goes beyond that which is merely attractive as an excitant of the child's interest. It is essential that he learn to attend voluntarily, i.e. that he learn to turn toward and fixate objects which do not attract from the outset. Thus the man of science, by virtue of his general 'scientific interest,' becomes absorbed in those minutest details of natural phenomena which to the dilettante are dry and uninteresting.

Consult: Stout, *Analytical Psychology*, vol. i. (London, 1896); Sully, *Human Mind*, vol. iii. (ib., 1892); Höfler, *Psychologie* (Vienna, 1897); Baldwin, *Handbook of Psychology, Feeling and Will* (New York, 1891); Adams, *Herbartian Psychology Applied to Education* (Boston, 1898).

INTERFERENCE (from *interfere*, from OF. *entreferir*, to exchange blows, Fr. *interférer*, to interfere, from Lat. *inter*, between + *ferire*, to strike). In any medium capable of transmitting waves, the effect at any point when two trains of waves are passing simultaneously is the sum of the effects which each wave by itself would produce, provided that the amplitudes of the waves are small compared with the wave-lengths; so that the resultant motion is the combination of the two waves. This is called 'interference.' The interference of two trains of waves on the surface of water is often seen. The phenomenon of 'beats' in acoustics (q.v.) is due to interference. Waves in all media, air, water, the ether, etc., can be made to interfere; and, conversely, if interference phenomena occur in connection with any physical action, it is evident that this action must be due to wave-motion.

One of the simplest cases of interference is when two identical trains of waves are sent out from two vibrating sources close together. At any point whose distances from the two sources differ by half a wave-length, by three half wave-lengths, or by any odd number of half wave-lengths, the action of one train of waves is permanently neutralized by that of the other. Whereas, at any point whose distances from the two sources are equal, or differ by a whole wave-length, or by any number of whole wave-lengths, the action is twice what it would be, due to either train of waves by itself. Thus, let light of one definite wave-length, i.e. of a definite color, e.g. yellow, be passed through a narrow slit in an opaque screen and fall upon a second opaque screen in which there are two other narrow slits parallel to the first and at equal distances from it; if this pair of slits are close together, and if the light from them falls upon a distant screen of some kind, there will be bands of colored light upon it, separated by dark bands where the action of the waves from one slit is neutralized by that of the waves from the other. The device of having the two slits illuminated by light coming from the first slit is in order to secure two *identical* sources of waves; for if the sources were to send out different waves, or waves without any definite phase-relation, there could be no permanent interference. In a perfectly similar manner waves in the air produced by whistles may be made to give 'interference bands' of silence and sound. The distance apart of the bands in any case evidently varies directly as the wave-length of the trains of waves. See LIGHT.

Another case of interference is seen in the beautiful colors of soap-bubbles, of thin films of oil on water, etc. These colors are due to the fact that when white light falls upon the thin transparent film, some is reflected at the first surface and of the light that enters the film some is reflected at the second surface, and the rest transmitted. There are, of course, a series of internal reflections; and looking at the film from either side the eye receives waves which have passed over paths of different lengths. If the difference in phase is such as to amount to half a wave-length or any odd number of half wave-lengths of waves or any definite wave-length, they will be absent from the light received by the eye. But white light from which any train of waves is absent will appear colored, having the color complementary to that of the absent waves.

INTERIM (Lat., in the meantime). The name given to three attempts made in Germany during the Reformation to draw up a formula which might serve as a basis of agreement between Catholics and Protestants until the points of difference could be decided by a general council. The *Ratisbon Interim* was the result of the deliberations of a commission appointed during the Diet of Ratisbon in 1541, of which Eck, Pflug, and Gropper were the Roman Catholic, and Melanchthon, Bucer, and Pistorius the Protestant members. On the greater number of doctrinal points the commission found it possible to agree on terms which might be deemed consistent with the views of both parties; but as to the sacraments and the power of the Church, the differences were irreconcilable. At the next Diet at Augsburg in 1548, a new interim at the command of the Emperor, Charles V., was prepared by Pflug, Helding (Sidonius), and Agricola. It is called the *Augsburg Interim.* In it the use of the cup by the laity, the marriage of priests, and some other minor things, were conceded to the Protestants; but it met with very general opposition, particularly in the north of Germany, and was revoked in 1552. By the exertions of the Elector Maurice of Saxony, a third interim, the *Leipzig Interim*, was adopted at the Diet of Leipzig, December 22, 1548, which guarded the Protestant creed, but admitted great part of the Roman Catholic ceremonial, and recognized the power of popes and bishops when not abused. It was the work of Melanchthon, Bugenhagen, Cruciger, Major, Eber, and Pfeffinger. It proved no more satisfactory than those which had preceded it and gave rise to the adiaphoristic controversy. (See ADIAPHORISTS.) Consult: Beutel, *Ueber den Ursprung des Augsburger Interim* (Dresden, 1888); Druffel, *Briefe und Acten zur Geschichte des 16. Jahrhunderts* (Munich, 1875).

INTERIOR, DEPARTMENT OF THE. One of the nine executive departments of the United States Government, whose chiefs constitute the President's Cabinet. (See CABINET.) It was organized in 1849. At its head is the Secretary of the Interior, whose salary is $8000, and associated with him are two Assistant Secretaries whose salaries are $4500 and $4000 respectively. The scope of this department is wide and diversified. It has supervision of Indian affairs; of the public lands, including mines; of pensions; of patents; of the census, when directed by law; of the geological survey; of education; of the custody and distribution of public documents; of railroads which have received subsidies from the United States; of the Territories; of national parks and reservations; of some charitable and penal institutions in the District of Columbia; of the returns office in which are filed returns of contracts made by the Secretary of War, the Secretary of the Navy, and the Secretary of the Interior, and of some other miscellaneous business. Most of the bureaus into which the department is divided are presided over by commissioners, appointed by the President by and with the advice of the Senate; but the Secretary's office is the great clearing house of the department, and the various commissioners are subject to the Secretary's directions in the performance of their executive duties.

INTERIOR BALLISTICS. See BALLISTICS.

INTERJECTION (Lat. *interjectio*, a throwing between, from *interjicere*, to throw between, from *inter*, between + *jacere*, to throw). One of the parts of speech. (See GRAMMAR.) Interjections proper are merely emotive reflex movements of the vocal organs, accompanied by voice, as *ouch, O, grrh, poo, ei*, and many of a like nature. Sounds of this type are the most primitive of all forms of speech, and are the only sort of vocal language shared by man with other animals. The present tendency of logicians is to treat the interjection as the most primitive form of judgment. The term interjection is often applied to vocatives and imperatives when they are employed as isolated exclamations, as *heavens, the deuce, alas, Charles, stop, go on*, and the like. The vocative interjection may be a representative of the single-membered sentence consisting of a subject only with no predicate. This is not undisputed, however, for there certainly is in many cases, and may perhaps be in all, an ellipsis of a predicate. The imperative interjection seems to be a predicate with an ellipsis of the subject. It is to be noted that though interjections proper stand isolated and complete in themselves, both vocative and imperative interjections are frequently elliptical, and, strictly speaking, equivalents for sentences, and are not real sentences as are the true interjections. Consult: Delbrück, *Grundfragen der Sprachforschung* (Strassburg, 1901); Wundt, *Sprachgeschichte und Sprachpsychologie* (Leipzig, 1901).

INTERLAKEN, ĭn'tĕr-lä'ken ('between the lakes'). A summer resort of Switzerland, delightfully situated on the left bank of the Aar, in the Bödeli, a plain between lakes Thun and Brienz (Map: Switzerland, B 2). The name is applied to the whole plain, which is from 5000 to 6000 feet above sea-level. Its mild climate (averaging 48° F.), dry air, and its magnificent mountain scenery, which includes views of the famous Bernese Alps, make Interlaken one of the most popular resorts in the Alps. It is visited annually by between 30,000 and 50,000 tourists. The town proper consists of the villages of Aarmühle, Matten, and Unterseen. There are numerous good hotels, restaurants, and a Kursaal on the Höneweg—the principal avenue. The chief building is that of the old monastery, founded in 1130 and suppressed in 1528. It is now occupied by the Government offices and the hospital. During the season Catholic, Anglican, American, and Presbyterian services are held in its ancient church. Population, in 1888, 2014; in 1900 (commune), 2962.

INTERLINEATIONS (from ML. *interlineare*, to write between lines, from Lat. *inter*, between + *linea*, line). In a deed, will, or other legal instrument, additions or corrections, written either on the margin or between the lines. They do not invalidate or cast suspicion upon the instrument in which they appear, but there is a presumption that they were inserted after its execution, and that they are not to be taken as a part thereof. This presumption may, however, be rebutted by evidence that they formed a part of the original writing at the time of its execution. See EVIDENCE.

INTERLUDE (ML. *interludium*, from Lat. *interludere*, to play between, from *inter*, between + *ludere*, to play). In the drama, primarily a short performance interposed between the parts of a longer entertainment, as the play of *Pyramus and Thisbe* in the *Midsummer Night's Dream.* The term was early used of dramatic Moralities (q.v.), played in the intervals of banquets and other Court festivities. During the sixteenth century, however, interlude came to be the specific name for a rude form of dramatic representation which sprang from the Moralities, and was, as it chanced, historically intermediate between those and true comedy. It differed from the former in that its *dramatis personæ* consisted not of abstractions of moral qualities, but of real persons; it was shorter in dialogue and of a merrier and more farcical nature. The most noted author of such plays was John Heywood (q.v.), who flourished at the time of the great controversy between the Roman Catholic Church and the Reformed Church in England. His *Four P's* is an excellent specimen of this phase of the drama. A Peddler, a Pardoner, a Palmer, and a Poticary, each tries to tell the greatest lie. At last the Palmer happens to say that he never saw a woman out of temper; whereupon the others declare that his is the greatest lie that can be told, and gains for him the victory. In music, an interlude is a short melodious phrase played by an organist (generally extempore) between the stanzas of a hymn; also, any short instrumental selection played between portions of the Church service. Consult: Ward, *English Dramatic Literature*, vol. i. (London, 1875); Collier, *The History of English Dramatic Poetry*, vol. ii. (ib., 1831); Symonds, *Shakespeare's Predecessors in the English Drama* (ib., 1884); Dodsley, *Collection of Old English Plays*, 4th ed., vol. i. (ib., 1874).

INTERMARRIAGE. The intermarriage or intercourse of near relatives has been universally believed to entail degeneration upon the offspring, and the act has been condemned and prohibited. The physical deformity and mental debasement of the Cagots of the Pyrenees, of the Marrons of Auvergne, of the Sarrasins of Dauphiné, of the Cretins of the Alps, and the gradual deterioration of the slave population of America, have been attributed to consanguineous alliances. More recently, the same opinion has been supported by the history of deaf-mutism and of idiocy. Of 235 deaf and dumb children whose parentage could be traced, 70, or nearly 30 per cent., were the offspring of the intermarriage of blood-relations. But in opposition to, and apparently destructive of such an hypothesis, may be adduced the unimpaired condition and symmetry of the Jews, of the small Mohammedan communities in India, of the isolated tribes in North America, among whom the repeated intermarriage of near relatives is compulsory. Moreover, this opinion does not hold in the analogous cases among the inferior animals. (See BREEDS AND BREEDING.) Darwin states that the first and fundamental law of heredity is that every attribute of the parents tends to be inherited by the offspring. Opposing influences counteract the tendency. If two brothers inherit strongly the characters of one of their parents, and if each transmits these characters strongly to his children, the cousins thus produced will have not only a close relationship of blood, but a close similarity of physiological characters, and if they marry, their offspring will be likely to be imperfect (Mercier). Insanity follows consanguineous marriages where the contracting parties inherit the same tendencies of a neurotic nature. If one of two brothers shows a reversion to a maternal ancestor, and the other inherits the father's character strongly, the first cousins springing from such brothers will have considerable physiological dissimilarity, and if these cousins marry their offspring are likely to be well developed. See CONSANGUINITY.

INTERMEDIATE STATE. The condition of the disembodied spirit from the hour of death till the general resurrection. References to this condition in the Bible are few and vague, and in the absence of definite information several theories have been elaborated. (1) Probably the most popular view is that the souls of the righteous pass to heaven and those of the wicked to condemnation immediately upon death. Passages like Luke xxiii. 43, xvi. 22-23, are held to favor this view. (2) A second theory is that the intermediate state is one of sleep or unconsciousness. This was taught as early as the middle of the third century by certain Arabians called Thnetopsychites, and combated by Origen. It was disapproved by the University of Paris in 1240, and by Benedict XII. in 1366. It was revived by certain Swiss Anabaptists and opposed by Calvin. It has been held by a few in later times, most notably by Archbishop Whately. (3) It is held that an intermediate place is provided wherein the souls of the dead exist until the day of resurrection. The most definite form of this view is the Roman Catholic doctrine of purgatory. The Church only lays down as *de fide* that there is a place of purification for departed souls, and that the souls detained therein are aided by the prayers and masses offered by the faithful on earth (Council of Trent, sess. vi., xxii., xxv.). The doctrine of purification after death for those who die in God's favor but not yet sufficiently free from imperfections to enter His presence, is supported by reference to such passages of the New Testament as Matt. xii. 32, I. Cor. iii. 11-15, Matt. v. 25, as well as by a continuous tradition, of which Tertullian speaks at the end of the second century as already old, and of which the custom of praying for the dead, universal in the early Church, is good evidence. The doctrine is also held to satisfy the demands of common reason, since it is difficult to imagine people of ordinary mixed characters, neither very good nor very bad, passing immediately into a state of perfect beatitude or being condemned to unending punishment. As to whether purgatory is a definite place, and as to the method of purification employed, nothing has been defined; it is clearly understood, however, that no matter what are the pains incident to the purifying process, the souls undergoing it do so willingly and gladly, since they know that each moment brings them nearer to the goal of their desire, union with God.

Modern theology is deeply interested in the history of the doctrine of a purification by fire. It is generally granted that its earliest appearance is in the Persian idea of a purifying conflagration preceding the final victory of Ahura Mazda, by which everything that is impure will be consumed. There is evidence that this doctrine passed from the Persians to the Jews and Christians. The *Sibylline Oracles* show how widely the conception of an ordeal by fire through which the good would pass unscathed was accepted in Christian as well as Jewish circles in the second century A.D. This, however, is only one root of the doctrine of a purgatory. Another was the anxiety about those who had died before the appearance of the Messiah and His kingdom. Jews prayed for them; Christians were baptized for them (I. Cor. xv. 29); Christ Himself was supposed to have gone to Hades after His death to preach the gospel to some of them (I. Peter

iii. 19, 20; iv. 6). While the Gnostic reaction eliminated the notion of a sudden conflagration of the world, it emphasized the impurity of matter and the gradual purgation of the soul, and thus paved the way for a general acceptance of the doctrine as found in the Alexandrian fathers. Consult: Coleridge, *Prisoners of the King* (London, 1878); Jungmann, *De Novissimis* (Regensburg, 1871); Bautz, *Das Fegfeuer* (Mainz, 1883); and see HADES; HEAVEN; HELL; IMMORTALITY; JUDGMENT, FINAL; RESURRECTION; INDULGENCES; PROBATION AFTER DEATH.

INTERMEZZO, ĭn'tĕr-mĕd'zô (It., interlude). In larger instrumental works, a short movement in slow tempo inserted between two main movements. It generally takes the place of the slow movement if the composer does not wish to write a full andante or adagio, as in Beethoven's Sonata op. 53. In Schumann's Concerto in A minor the intermezzo is sufficiently extended to be considered the legitimate slow movement of the work. Sometimes an entirely separate and independent composition bears the title intermezzo. In the old suite any extra movements added to the four obligatory ones (allemande, courante, larabande, gigue), and always inserted between the third and fourth are called intermezzi. The intermezzos originally were short musical interludes or entr'actes which it was customary in Italy to perform between the acts of a tragedy. When the *opera seria* begin to flourish in the seventeenth century, intermezzos treating some mythological subject were performed between the acts. Originally the different intermezzos had no connection one with the other. But gradually the intermezzo became a secondary plot. For the sake of variety it always treated a comic subject, so that a performance of an *opera seria* consisted alternately of a serious act of the opera itself and a comic act of the intermezzo. The next step was the emancipation of the intermezzo into a separate art form, the *opera buffa*. Its place in the *opera seria* was then taken by the ballet (q.v.). The intermezzos in the spoken drama of to-day are purely instrumental. Two famous examples of intermezzos written for dramas are the music to Goethe's *Egmont* by Beethoven, and the music to Shakespeare's *Midsummer Night's Dream* by Mendelssohn.

INTERMITTENT FEVER. A form of fever in which the rise of temperature above the normal (98.4° F.) is not constant, but in which there is a defervescence, or fall of temperature to the normal point, at intervals, to be followed by successive rise to an abnormal point. The interval or intermission may be a few hours long (as in the double quotidian type of malarial fever), or it may be two days long (as in the quartan type of malarial fever). The intermittent form of fever occurs in abscess of the liver, in chronic obstruction of bile-passages by gallstones, in Hodgkin's disease, in pyæmia, in pyelitis, in septicæmia, in secondary syphilis, in tuberculosis, and in some forms of malarial fever. The term, however, has been principally and popularly used to denote the ordinary tertian type of malarial fever, as a synonym of 'chills and fever,' and replacing the old term 'ague.' See MALARIA.

INTERNAL REVENUE SYSTEM. The revenue derived by the United States Government from taxation other than that of imports is commonly designated as internal revenue. In its widest sense the term includes the direct taxes levied in accordance with the constitutional rule of apportionment according to population, in 1798, during the War of 1812, and in 1861. But as the constitutional rule noted differentiates such direct taxes widely from all other forms of internal taxation, we may properly exclude them from the discussion of the internal revenue.

Internal taxation did not acquire a permanent place in our fiscal system until 1862, though the nation had, in 1794, 1800, and 1813-17, gained some experience in this form of taxation. This earlier experience was not without value to the financiers of the Civil War, and may be briefly examined here.

Soon after the inception of the national government, the revenues proved to be inadequate. The fiscal policy of Hamilton had not sought to evade the responsibilities which the creation of a national government imposed, and the burden of State debts created in the common struggle for independence was assumed by the nation. The debt charges assumed in this manner were considerable, and the customs revenues insufficient to discharge them. As early as March, 1790, the Secretary of the Treasury proposed that excise taxes be laid upon snuff and tobacco, carriages, sales at auction, stamps, and on wines and distilled spirits. Alcoholic beverages were subjected to a moderate tax by an act of March 3, 1791. Liquors produced from foreign materials were taxed at rates ranging from 11 to 30 cents a gallon, and those produced from domestic materials at rates ranging from 9 to 25 cents. The act was very unpopular, and gave rise to much opposition, which interfered greatly with its operation, increasing the costs of collection and diminishing the returns. Nowhere was this opposition stronger than in western Pennsylvania, where, in 1794, a display of military force was necessary to put down the uprising known as the Whisky Insurrection (q.v.). Despite the falling off in receipts, due to this opposition, the revenues could not be dispensed with, and further taxation became imperative. In June, 1794, carriages, sales at auction, snuff, sugar, and tobacco were made taxable, and licenses were required for the sale of wines and liquors. Taxes on legal instruments were imposed in 1797. These measures were enacted in the face of vigorous opposition. As to the carriage tax in particular, the constitutional objection was raised that it was a direct tax and not levied in the manner prescribed, and when this failed to impress Congress, the matter was carried to the courts. The Supreme Court of the United States, in Hylton *vs.* the United States, upheld the act, and in effect declared that land and capitation taxes were the only direct taxes in the constitutional sense. The opposition to this form of taxation was due to the fear that thereby the Federal Government would gain increased power, and we may well surmise that Hamilton's advocacy of these measures was in part influenced by the desire to assert as soon as possible all the power which he believed to reside constitutionally in the Federal Government.

With the rise of the Democratic Party to power in 1801 all forms of internal taxation were abandoned. Party principles were opposed to them, and the treasury did not need them. Revenues from customs amply supplied all needs and permitted a considerable reduction in the public debt.

When the War of 1812 broke out there was at first no thought that any additional revenues would be needed for current expenses, and it was believed that the costs of the war could be met by loans. Both public revenue and public credit were impaired by such a policy. In 1813 it became necessary to seek new sources of revenue, and, by acts of July 24 and August 2, 1813, those taxes which had proved most advantageous before the opening of the century were reimposed. Duties on carriages, on sugar refined in the United States, license taxes on the distillers of spirituous liquors, and on retailers of wines and spirits, with stamp duties on legal instruments, etc., and taxes upon sales at auction, reappeared. These taxes were, however, designated as temporary, and the pledge was made that they should be repealed within a year from the close of hostilities. As it took some time to create the machinery for the collection of these taxes, the actual returns were slow in coming in. Before any appreciable revenue had been derived from this source ($1,662,984 being collected in 1814), rates were increased in December, 1814, and new taxes were imposed in January, 1815. They embraced pig-iron, iron castings, bar and rolled iron, nails, candles, paper, leather, playing-cards, vellum, hats, umbrellas, saddles, bridles, boots, shoes, beer, ale, tobacco, cigars, and snuff.

For the actual conduct of the war these taxes came too late to be available, but in the settling up of accounts they proved of great assistance. The Secretary of the Treasury was unwilling to part with them wholly, and advocated the retention of a part of the excise system, in order to meet any emergency which might arise. Congress, however, by act of December 23, 1817, abolished these taxes, and no further resort was had to internal taxation until the Civil War.

When the great struggle opened it was generally believed that the war would soon be terminated, and that the expenses of the contest could be entirely provided by loans. As in 1812, there was a delay in the creation of new sources of revenue. A direct tax of $20,000,000 was levied on the States by act of August 5, 1861, but it was not until July 1, 1862, that an act was passed to raise any considerable revenue from internal taxation. The law embraced almost every conceivable object of taxation. There were taxes on liquors of all kinds, license taxes upon merchants, taxes on all manufactured articles, on auction sales, carriages, yachts, billiard-tables, plate, the gross receipts of railroads and other transportation companies, on the dividends of banks, trust, savings and insurance companies, on advertising, on incomes over $600, on legacies, and stamp taxes upon bills of exchange and other mercantile papers. It took some time to establish the machinery necessary to the proper administration of this system of taxation; it produced in the fiscal year 1863 only $37,640,787, though its advocates had anticipated a revenue of $100,000,000. In the following fiscal year these taxes produced $109,000,000, without any change in rates. The demand for increased revenue led, June 30, 1864, to increased rates. New objects of taxation were discovered, and rates were considerably increased upon articles already taxed. On manufactured products generally the rate changed from 3 to 5 per cent., while on specific articles it was doubled. On liquors rates rose from 60 cents per gallon, under the law of March 7, 1864, to $1.50 and $2, while the maximum rate on tobacco rose from $3.50 per thousand to $40 per thousand, the latter rate applying to cigars valued at $45 per thousand. The revenue rose in the fiscal year 1865 to $209,000,000, but it was not in those articles which were so extravagantly taxed that the increased revenue was most conspicuous. Indeed, the product of the tax on distilled liquors fell from $30,329,149 to $18,731,422, while that of the tobacco taxes rose only from $8,592,098 to $11,401,373. A further increase of rates was made by an act of March 3, 1865, and the fiscal year 1866 with revenues of $309,226,813 showed the high-water mark of internal revenue receipts.

The increase of revenue resulting from these several acts was rapid, and the annual deficit grew relatively smaller, as compared with revenues, although it increased absolutely as the war progressed. Even more important, perhaps, than the actual revenue received was the improvement in public credit, which resulted from these serious efforts to place the revenues on a sound basis. The last act, while raising rates, contemplated their speedy reduction, and provided for the appointment of a revenue commissioner charged with the duty of studying the whole revenue system and proposing suitable modifications. Extraordinary military expenditures were no longer required, but the general scale of national expenditure was vastly greater than before the war. The abolition of internal-revenue taxation was not thought of, but a reduction of the burden and the removal of some of the more vexatious taxes was generally demanded. By a series of acts in the years 1866, 1867, and 1868 many taxes were abolished, and rates on many others diminished. It was estimated that $196,000,000 would be taken from the revenue, but the actual diminution was less than $1,250,000. The greater productivity of moderate rates was amply demonstrated. In the case of distilled spirits a rate of 50 cents a gallon, enacted July 20, 1868, produced in the fiscal year 1870 a revenue of $55,606,094, while the maximum revenue under the $2 rate in 1867 had been $33,542,951.

In 1870 taxes still remained on spirits, tobacco, fermented liquors, gross receipts, licenses, incomes, legacies, successions, gas, stamps, and some few other articles. The income tax, which in 1870 had produced $37,775,873, was abandoned in 1872. Few changes have since been made. The tax on spirits was raised to 90 cents in 1875, but elsewhere, especially on tobacco, there was a reduction of rates, and all stamp taxes ceased in 1883. While ultra-protectionists like William D. Kelly urged the abolition of all internal taxes, this plan did not secure any large following, the sentiment in favor of taxing liquor and tobacco, the main supports of the internal revenue, being well-nigh universal. The experience of recent years has, moreover, firmly demonstrated in the minds of the people that such taxation of the internal resources of the nation is an indispensable element in any revenue system, since it is capable of adjusting itself to the needs of a sudden emergency.

No essential changes were made in the system of internal taxes till 1894, when the Tariff Act of August 28th sought to compensate for the propective falling off in customs duties by raising the tax on distilled spirits from 90 cents per gallon to $1.10 per gallon, and by imposing a tax upon incomes. The Supreme Court of the United States decided the income tax established by the law to be unconstitutional (see INCOME TAX), while the increased rate on spirits did not prevent a diminution of revenue from that source.

When, in 1898, war was declared against Spain, internal taxation was chiefly relied upon to meet the increased expenditures. In framing the War Revenue Act of 1898 there was ample experience to draw upon, and that measure shows a judicious use of the taxing power. The act, which went into effect on July 1, 1898, provided an increase of rates upon some articles and reëstablished some of the taxes which the experience of 1862 and 1870 had demonstrated to be most productive. It imposed a special tax on bankers, brokers, proprietors of theatres, circuses, and other entertainment enterprises, tobacco dealers and manufacturers. It left untouched the rates on distilled spirits. On fermented liquors and also on tobacco and snuff the rates were doubled, while on cigars and cigarettes, previously heavily taxed, they were slightly increased. An important feature of the law was the imposition of stamp taxes upon mercantile papers of all kinds and upon proprietary articles (patent medicines) and wines. The revenue receipts under the law as amended are shown in the following table, which gives for comparison the years 1897 and 1898:

Fiscal year ending	Internal revenue receipts
June 30, 1897	$146,619,593.47
June 30, 1898	170,866,819.36
June 30, 1899	273,484,573.44
June 30, 1900	295,816,107.57
June 30, 1901	306,871,669.42

A comparison of receipts in 1897 and 1899 will show the effect of the new law, and will also reflect the increasing prosperity of the country, as shown in the larger returns of 1898 in the foregoing table, without change of rates:

FISCAL YEAR ENDING JUNE 30

	1897	1899
Spirits	$82,008,542.92	$99,283,534.16
Tobacco	30,710,297.42	52,493,207.64
Fermented liquors	32,472,162.07	68,644,558.45
Special taxes	....	4,921,593.21
Legacies	....	1,235,435.25
Stamps	....	43,837,816.66
Miscellaneous	1,628,691.06	3,068,426.07
	$146,819,693.47	$273,484,571.44

With the return of peace the demand for a reduction of revenue became general. By a law of March 2, 1901, taking effect July 1, 1901, considerable reductions were made, the tax on fermented liquors being reduced from $2 per barrel to $1.60, the maximum cigar tax going back to what it was before the war, while all stamp taxes on proprietary articles and the most troublesome taxes on business papers, such as bills of lading, express receipts, certificates of various kinds, insurance contracts, mortgages, bank checks, and telegrams, were repealed. A further act of March 2, 1902, which went into effect July 1, 1902, removed the last vestiges of the war taxes, old rates being restored and the remaining new taxes being abolished. Consult Howe, *Taxation in the United States Under the Internal Revenue System 1791-1895* (New York, 1896). See FINANCE; TAX AND TAXATION; INCOME TAX.

INTERNATIONAL AFRICAN ASSOCIATION. See AFRICAN INTERNATIONAL ASSOCIATION.

INTERNATIONAL COPYRIGHT. See COPYRIGHT.

INTERNATIONAL DATE-LINE. An irregular line drawn somewhat arbitrarily on the map of the Pacific Ocean, near the 180° meridian of longitude. It marks the place where navigators 'change their date' on the trans-Pacific voyage. The following is a brief explanation of the cause of this change of date. When a person travels westward, he lengthens his day by one hour for every 15 degrees, since he moves along with the motion of the sun; by going westward entirely round the earth, lengthening each day by a certain amount, four minutes for every terrestrial degree he travels, he will have lost one day at the arrival at the starting-point. The second of a month, for example, is to him the first; Monday is Sunday, according to his reckoning. This is obvious, since by going round the earth from east to west he has, in respect to himself, diminished by one the number of revolutions made by the earth during this time. Going round the earth eastward the reverse takes place, and a person gains one day, since he makes one more revolution than the earth does. Thus two persons, having started from the same place and traveled round the earth in opposite directions, when they meet at their place of starting, will differ from each other two days in their reckoning. Thus it becomes necessary to have a date-line somewhere on the earth's surface, since it is impossible that the reckoning of days should go unbroken round the earth. Any meridian might do, theoretically, for this purpose, but for two important practical reasons the 180° meridian of longitude has been chosen for the international date-line. These two reasons are: (1) that it lies nearly in the middle of the Pacific Ocean, and thus far away from civilization; (2) it is exactly twelve hours from Greenwich, which is, however, of minor importance. Thus the theoretical date-line coincides with the 180° meridian; but for reasons of convenience an arbitrary irregular line has been adopted in its place. This line is shown on the accompanying map; it has the advantage that no change occurs between important neighboring islands.

Since the line is an arbitrary one, we might expect cartographic authorities to differ considerably in its delineation; and this is, in fact, the case. Indeed, to have such a line drawn with perfectly definite authority, it would be necessary for the principal nations to have the line determined by a joint commission, and then to adopt the commission's recommendations by international agreement or treaty. But this has never been done, and so in one sense it may be said there is no *international* date-line. The term has, however, come into general use, and may well be employed pending such governmental action. The matter might be dealt with very appropriately if there should ever be another Prime Meridian Conference (q.v.). But in the absence of international agreement, it is possible at least to mark out the line as it is actually used in the Pacific islands. For this purpose it is merely necessary to find out, by correspondence with all the various settlements, whether the date in public use is the American or Asiatic one. Correspondence of this kind has been carried on by Prof. George Davidson, of the University of California, and formerly of the United States Coast and Geodetic Survey. His results have been published by the United States Government, and form the basis of the accompanying map, which presents unquestionably the most authoritative date-line so far placed at our disposal. The principal change from other recent authorities transfers Morell Island to the east of the line. The change of the Samoan Islands from west to east was made by order of King Malietoa in 1892. See ANTIPODES; TIME, STANDARD.

INTERNATIONALE, or **INTERNATIONAL WORKINGMEN'S ASSOCIATION.** An attempt to unite workingmen of all nations into an organization which should have for its purpose the protection, the coöperation, and the complete emancipation of the working classes. It was an international movement in harmony with the growing feeling of solidarity and common interests which was centralizing the national unions during the latter half of the nineteenth century. The founding of the International Association of Workingmen was occasioned by a visit of French workingmen to the International Exhibit in London in 1862. They came in contact with English trade unionists, recognized their common interests, and as a result a meeting of workingmen of all nations was held in London, September 28, 1864. A provisional committee was appointed to draw up a constitution, which was drafted by Marx after Mazzini's ideas had failed to meet with approval. A general council with headquarters in London was appointed. Sixty delegates were present at the first congress in Geneva, in September, 1866, where an eight-hour day was approved, and a system of education discussed. At Lausanne in 1867 socialistic principles were first adopted, with the result that its English adherents, whose ideal was trade unionism, withdrew from the movement. At the third and most important congress at Brussels in 1868 the congress announced itself opposed to war, advocated a general strike in case of war, and declared itself in favor of State ownership of mines, land, and transportation facilities. Bakunin and other anarchists joined the fourth congress at Basel in 1869. In that year the Social Democratic Party was founded in Germany, representing in politics the principles of the International. The Franco-Prussian War prevented the meeting of the fifth congress at Paris. In 1872 at The Hague congress the anarchists were expelled, and the general council removed to New York. A last congress, representing chiefly the anarchistic wing of the party, was held at Geneva in 1873. For some years this faction carried on a fiery agitation in the south of Europe, but with the death of Bakunin in 1876 it disintegrated, its members becoming the anarchistic communists of to-day. The Marxist wing developed in other countries, as well as in Germany, into Social Democratic parties. Branches of both factions were formed in the United States, but were never firmly established. In the American movement the anarchistic faction showed the greater strength. This faction broke up into two rival associations, the International Working People's Association and the International Workmen's Association, the latter representing the more radical principles. While it existed the International aided strikes of bronze-workers in Paris (1867) and builders in Geneva (1868), and helped English trade unionists by preventing the importation of cheap labor. A number of journals in different countries were devoted to its cause.

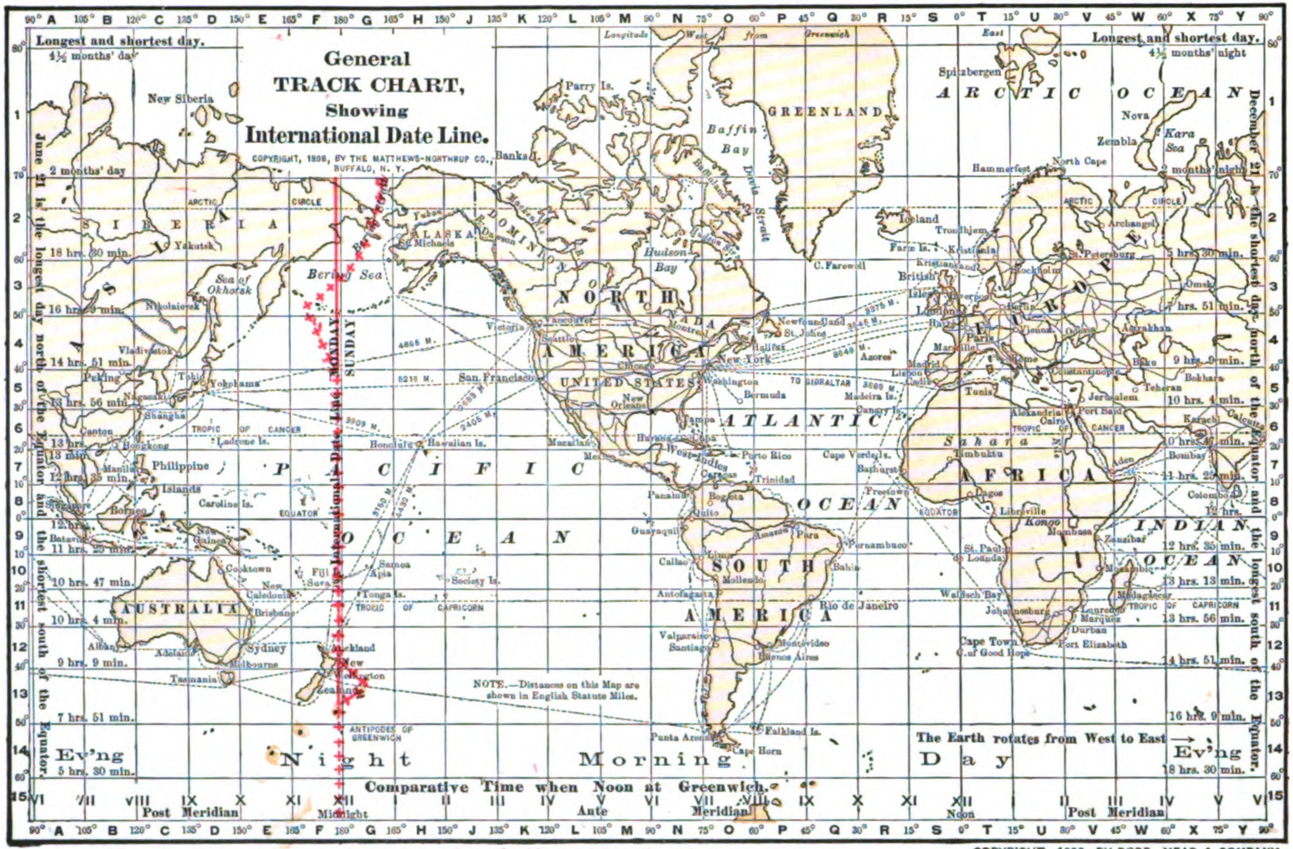
Consult: Kirkup, *History of Socialism* (London, 1892); Rae, *Contemporary Socialism* (2d ed., New York, 1901); Ely, *Labor Movement in America* (New York, 1886).

INTERNATIONAL EPISODE, AN. A novel by Henry James (1878). It tells of a trip to America by two Englishmen, one a lord, during which they meet some charming American women. They in turn visit England, the acquaintance proceeds to courtship, but the Boston girl refuses his lordship, after a glimpse of the power of family influence.

INTERNATIONAL INSTITUTE OF SOCIOLOGY (Fr. *Institut International de Sociologie*). A French scientific society founded in July, 1893. The membership is small, about twenty, and almost entirely confined to Europe. Congresses are held from time to time for the discussion of sociological topics.

INTERNATIONAL LAW. To adopt Bentham's terminology instead of the older and still common expression, 'Law of Nations,' 'International Law' is the collection of rules, whether based upon custom, convention, or common consent, which are acknowledged and accepted as binding modern civilized and independent nations in their mutual dealings.

The question whether these rules are law in the abstract and technical sense of the word is purely academic and has little practical importance; for in England and in the United States international law is regarded as part of the common and municipal laws of the respective countries. Lords Talbot and Mansfield expressly so held (Triquet *vs.* Bath, 1764, 3 Bur. 1478); Blackstone in his *Commentaries* published a year later laid down the doctrine in unmistakable terms: "The law of nations . . . is here adopted to its full extent by the common law and is held to be a part of the law of the land;' the Constitution of the United States acknowledged it in giving Congress power to punish "offenses against the law of nations;" for nations punish violations of domestic, not of foreign law, and the Supreme Court has held in a case arising out of the recent Spanish-American War that the law of nations is nothing more nor less than a branch of our municipal law: "International law is part of our law, and must be ascertained and administered by the courts of justice of appropriate jurisdiction, as often as questions of right depending upon it are duly presented for their determination. For this purpose, where there is no treaty, and no controlling executive or legislative act or judicial decision, resort must be had to the customs and usages of civilized nations; and, as evidence of these, to the works of jurists and commentators, who, by years of labor, research, and experience, have made themselves peculiarly well acquainted with the subjects of which they treat. Such works are resorted to by judicial tribunals, not for the speculations of their authors concerning what the law ought to be, but for trustworthy evidence of what



Theoretically the change of date should be along the 180 meridian of longitude. For practical purposes the International Date Line has been generally adopted as marked on the map, thus: + + + + + + + + + +

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the law really is." (Paquette Habana, 1899, 175 U. S. 677.)

It would appear, therefore, that as far as the United States is concerned, international law rests upon the following bases: (1) treaties; (2) acts of the executive in international matters; (3) acts of Congress; (4) judicial decisions of American and prize courts; (5) customs and usages of civilized nations. Text-books are not law *per se*, but evidence of the law, so that Lord Salisbury's sarcasm—"International law . . . depends generally on the prejudices of the writers of text-books"—loses much of its point in this country. The prejudices of the writers should be discarded, but their texts cannot be overlooked.

Hugo Grotius (1583-1645), in his *De Jure Belli ac Pacis Libri Tres* (1625), is the father of the science of international law in the same way, and in a larger sense than Adam Smith, by his *Wealth of Nations* (1776), is the creator of the modern science of political economy. The *jus feciale* of the earlier Roman law, regulating the formal intercourse between Rome and other nations, might have produced a system of international law if Rome had not made one nation of the world. But as Mr. Robertson well says: "Positive international law does not in fact come into existence until the era of Grotius, although usages of international intercourse must at all times have existed." Among the most famous followers of Grotius are Puffendorf (1632-94); Wolf (1679-1754); Vattel (1714-67); and the Dutch jurist Bynkershoek (1673-1743), whose authority is second only to that of Grotius. In America the most illustrious names are Kent (1763-1847); Wheaton (1785-1848); Halleck (1817-72); Woolsey (1801-89); Dana (1815-82), whose notes to Wheaton's classic 'Elements of International Law' are invaluable; Wharton (1820-99); and Moore (1861—). (For the writers on international law and a criticism of their work, see Rivier's sketch in Holtzendorff's *Handbuch des Völkerrechts*, French trans., vol. i., pp. 351-494.) To these illustrious names should be added those of the judges Sir Leoline Jenkins (1623-85) and Lord Stowell (1745-1836) in England, Marshall (1755-1835) and Story (1779-1845) in the United States.

International Law in Time of Peace. The subjects or persons of international law are independent sovereign States or nations. The community constituting such State is (1) permanently established for a political end; (2) it is possessed of a defined territory; (3) it is independent of external control. If one or more of these elements be lacking, the political community is not a State in the sense of international law. The United States, i.e. the Union, is sovereign; the individual States are unknown to the law of nations. When these requirements are present, we have a State the existence of which is proved like other questions of fact. Individuals choose their associates, and States likewise determine whether and when they wish to maintain relations with a newcomer. A failure to recognize the existence of a State having a rightful claim thereto would be an unfriendly act, but as the recognizing State is sovereign, recognition depends upon its will. It is therefore a political, not a judicial question. A revolted colony may have all the requirements except the element of permanency. A hasty recognition of its independence—France's recognition of the United States in 1778, for instance—helps to create the independence it professes to recognize. Such conduct is unfriendly in the extreme, and Great Britain not unjustly replied with war.

The form of government is immaterial. The Papal States (before 1870), the Empire of Russia, the Kingdom of Great Britain, the Republic of the United States, have an equal claim to recognition. The State is the corporation, and if the three essentials of statehood exist it does not matter who happens to be the chairman or public representative. Internal changes are likewise immaterial.

Publicists enter into minute classifications of States, but the matter is of little moment; a State is independent or it is not. If independent of external control, it is, internationally speaking, a sovereign State; if not independent of foreign control, it is internationally a cipher, and nations negotiate with the controlling power. Neutralized States (Switzerland, 1815; Belgium, 1831; Luxemburg, 1867) have, in the interests of European peace, engaged not to wage offensive war, and their independence is guaranteed on that condition.

A State possessing these three elements and so recognized by international law is termed a *de jure* State; one possessing these elements but not recognized is termed a *de facto* State. The Confederate States of America furnish the most imposing example of a *de facto* sovereign. The *de facto* States have the same claims upon subjects and residents as *de jure* States. The struggle they wage to compel the mother country's recognition of their independence is war if on a large scale, and they are entitled to all the rights of belligerents, such as exchange of prisoners, the right of visit and search on the high seas, etc. (See Belligerent.) If success crowns their efforts the *de facto* becomes a *de jure* sovereign State (American Revolution).

A fundamental proposition of international law is the equality of States, of which Chief Justice Marshall aptly said: "No principle of general law is more universally acknowledged than the perfect equality of nations. Russia and Geneva have equal rights. It results from this equality that no one can rightfully impose a rule on another. Each legislates for itself, but its legislation can operate on itself alone." It follows therefore that the doctrine of intervention or interference has no place in international law. See Intervention.

The Monroe Doctrine (1823), rightly understood, means non-intervention; for the United States will not intervene, but will enjoin intervention from an external source. Sir William Harcourt has felicitously analyzed the doctrine of intervention in the following passage: "It is a high and summary procedure which may sometimes snatch a remedy beyond the reach of law. Nevertheless, it must be admitted that in the case of intervention, as in the case of revolution, its essence is illegality, and its justification is its success; of all things, at once the most unjustifiable and the most impolitic is an unsuccessful intervention." See Intervention.

If the States are equal and sovereign, it necessarily follows that no State can extend its legislation beyond its borders. A nation's territory includes the land, the unincumbered space above the surface, and marginal seas. A river wholly within a country is subject to its jurisdiction; if it form the boundary, both nations have equal rights of navigation; if it rise in one and flow through another country, comity should allow the upper State to use the river to its mouth. But comity is not law, and rights of navigation in such cases are secured by treaties, as in the case of the Mississippi in 1795, and the Saint Lawrence in 1854.

Lakes belong naturally to the State inclosing them. In the United States the Great Lakes are considered high seas, and bodies of water connecting them with the ocean share their nature.

Marginal seas to a marine league from shore are subject to jurisdiction of the State washed thereby, and the State exercises jurisdiction over all merchant vessels found within this limit. If bays, gulfs, or other inlets are less than two marine leagues in width, they are likewise exclusively subject to the State, and even if the opening be greater than six miles, international law permits exercise of exclusive jurisdiction. Delaware and Chesapeake bays are inclosed, not high seas.

Merchant vessels on the high seas are subject to jurisdiction of the flag they float, for the reason that the seas are unappropriated and assumption of jurisdiction in such cases does not interfere with the rights of any other State. Hence, a crime committed by an American sailor on a British merchantman on the high seas would be triable in England; but a merchant vessel in a foreign port is subject to the jurisdiction of the port unless exempt by treaty. The French rule, widely adopted, exempts the vessel from jurisdiction of port unless crime committed on board disturbs the peace of the port. For reasons of State, war-vessels are wholly exempt from foreign jurisdiction.

Such is the property a State naturally owns. Other property, real or personal, may be acquired. The acquisition of personalty offers no difficulties, but the case is otherwise with realty. International law sanctions four methods of acquiring territory: (1) Occupation of vacant or unoccupied land, as in case of the American continent. Mere discovery, unaccompanied by use and occupation, vests no title (Oregon, 1846). (2) Prescription or possession for a long time. This method of acquisition is disputed, but sanctioned by the Supreme Court of the United States. (3) Gift, purchase, or treaty (Florida, 1819; Texas, 1845; Gadsden Purchase, 1853; Alaska, 1867; Hawaii, 1898). (4) Conquest (Mexican War, 1846-48; Spanish-American War, 1898, with cession of Porto Rico and the Philippines).

On suppression of rebellion, cession of territory or absorption, property rights, treaty obligations, and public obligations pass to the new sovereign, but non-political laws remain in force until changed by the new master. Vested private rights are unaffected by the change. Within its territory, however acquired, the State is sovereign and regulates its internal affairs in accordance with its Constitution. The citizen owes allegiance and receives protection. See ALIEN; CONQUEST; CONFLICT OF LAWS; JURISDICTION; HIGH SEAS; EXTRADITION.

Allegiance and protection are reciprocal; hence permanent allegiance demands permanent protection. When the citizen or subject leaves his country and settles elsewhere, to what extent may he claim protection from the home Government? Residence implies obedience and temporary allegiance, but it is well settled that submission to injustice is not a duty, and that a State may protect citizens in foreign parts against denial of ordinary justice. If the courts are open to them, they must there seek redress; if the courts are closed or so prejudiced as to make the proceeding useless, they may appeal to their country for diplomatic settlement. The nation may resort to reprisals or to war if necessary.

It should be noted that a State is liable for damage caused by mob violence to alien residents if such damage could have been averted by due diligence; but the State is clearly not liable for damage resulting from riots, civil commotion, or civil war in which property of aliens and citizens alike suffers.

For the purpose of securing justice to citizens abroad and for safeguarding its other interests, States employ two classes of agents: diplomatic and consular. The principle of State equality prescribes equality of representation; and as the political corporation, not the personal ruler, is represented, the form of government is clearly immaterial. Diplomatic agents are clothed with diplomatic immunity or inviolability. See INVIOLABILITY; DIPLOMATIC AGENTS; CONSUL, MERCANTILE.

It cannot be doubted that a State may contract as freely as a private individual. If the contract be with an individual, the State cannot be sued in court except by consent and on terms prescribed by it. In the United States the Court of Claims was organized in 1855, and exists for the purpose of such suits. Contracts between independent States are called treaties and are to be interpreted as ordinary contracts except that force and duress do not invalidate. By Article VI. of the Constitution a treaty is a law of the land and has equal but no greater force than an act of Congress.

Our courts consider treaties of two kinds: (1) commercial and temporary in their nature; (2) permanent as intended to set up a permanent state of affairs, as boundary agreements. The former are dissolved, the latter merely suspended, by and during war. See TREATY.

INTERNATIONAL LAW IN TIME OF WAR. Embargo, seizure in port of vessels belonging to nations with whom war is imminent; retorsion, retaliation upon foreign nations or subjects; and reprisal, seizure of foreign property in retaliation for wrong done, were formerly preliminaries to war. Their place is taken by pacific blockade of ports of the nation in order to coerce it into submission to the demands made. Pacific in name, it is war in effect. If these and other 'peaceable' measures fail to remove outstanding difficulties, the nations appeal to arms and war ensues with or without declaration, whether the cause be just or not. If war be declared, it dates from the declaration; in absence thereof, from the first really hostile act, for war is a fact and provable as such. Civil wars cannot be 'declared,' but belligerency exists nevertheless. While all citizens of nations at war are enemies, international law distinguishes between those in arms and non-combatants. The former wear uniform, act under officers commissioned by the State, and may be killed in battle or if captured held as prisoners until exchanged. Non-combatants, technically but not practically enemies, are treated as at peace, even in the presence of invading armies. The State, therefore, makes war by its agents (armies on land, fleets on sea), but levies en masse are permitted. The freebooter no longer exists on land and the privateer has been driven from the ocean. The declaration of the Convention of Paris (1856) abolished privateering, to which the civilized world agreed excepting Mexico, Spain, and the United States. In the War of 1898 the last two powers proclaimed the principles of the declaration.

The effects of war, immediate and well defined, are admirably set forth in the following extract from an adjudged case: "In a foreign or international war, from the time it is declared or recognized, all the people in the territory and subject to the dominion of each belligerent, without regard to their feelings, dispositions, or natural relations, become, and continue to the close of hostilities, in legal contemplation, the enemies of all the people resident in the territory of the other belligerent; and all negotiation, trading, intercourse, or communication between them, unless licensed by the Government, is unlawful. Such a war, as between the citizens or subjects of the respective belligerents, *ipso facto* dissolves all commercial partnerships and all contracts wholly executory and requiring for their continued existence commercial intercourse or communication; and while it does not abrogate, yet it suspends all other existing contracts and obligations and the remedies thereon, and renders all contracts, with rare exceptions, entered into pending hostilities, illegal and void.

"The familiar principles of public law, regulating conduct in foreign wars, have been applied by the courts of this country, State and Federal, to the war between the United States and the Confederate States.

"Limited agencies in the enemy's country may lawfully continue, provided they can be and are exercised without intercourse or communication between the citizens or subjects of the contending powers—such as agencies to collect and preserve, but not to transmit money and property." (Small *vs.* Lumpkin, 1877, 28 Gratt. 832.)

Contracts for ransom of captured property are valid although made between enemies during continuance of war. (See RANSOM.) On outbreak of war, debts due the enemy and enemy property on land may be confiscated, but modern practice, while it admits, makes no use of the right. No modern State would confiscate its debts or public obligations due to enemy subjects.

An invading army takes possession of personal property of the State likely to be useful in war, and arms and munitions of war although in private hands; but private property of enemy subjects is non-confiscable. Public property, such as public buildings, may be seized and occupied, their rents or revenues appropriated, and the municipality or country officered so far as necessary. The civil administration yields to the military; but the invader is an administrator or usufructary, not owner. Pillage is forbidden and private property is recognized, but contributions and requisitions for which receipts are given may be levied on the inhabitants.

The nineteenth century greatly humanized methods and means of warfare. The Geneva Convention (1864) neutralized ambulances, military hospitals, and all persons employed in hospital and medical service. The Red Cross was adopted as the distinctive badge of those so employed, and freed them from capture or military liability. The Peace Conference (1899) extended the principles of the Geneva Convention to naval warfare. The Saint Petersburg Convention (1868) declared that the end of war is to disable, not to kill, and forbade the use of any "projectile of less weight than 400 grams, which is explosive, or is charged with fulminating or inflammable substances."

The Brussels Convention (1874) was practically reasserted by The Hague Conference in its articles for the humane treatment of prisoners (see PRISONER), and the Peace Conference carried the reform a step further. See SPY; ARMISTICE; FLAGS OF TRUCE.

In naval warfare enemy property on enemy vessels is liable to capture, but since the Declaration of Paris (1856) the neutral flag covers enemy goods, and neutral goods on an enemy vessel are exempt from capture. The United States has uniformly maintained the inviolability of private property on the sea, and the contention may one day be law. But although liable to capture, the title to such property only passes to the individual and actual captor by the decision of a prize court.

War may end with or without a treaty. The war, it is held, has wiped out the causes thereof, and the nations begin afresh; if there has been no treaty, and territory has been occupied and is in the possession of one or other belligerent, the principle of *uti possidetis* obtains. But after an appeal to arms, nations generally take to pen and ink, so that the treaty is the rule.

Neutrals take no part, but are nevertheless affected by war, and their duties, although negative, are well defined and binding. A neutral should not allow its territory or marginal waters to be used for enlisting men, equipping vessels, fitting out expeditions, or as a basis of operations; nor should hostilities of any kind be permitted within its territory or marginal waters. (Three Rules of Treaty of Washington, 1871.) The failure to meet these negatives subjects a neutral to liability. (Geneva Award, 1872.)

The neutral, however, has a right to trade with the belligerent, but may not carry articles known as contraband. The penalty is ordinarily confiscation of cargo; the like penalty may attach to the ship. The nature of the trade appears from the following quotation: "The classification of goods as contraband or not contraband has much perplexed text writers and jurists. A strictly accurate and satisfactory classification is perhaps impracticable; but that which is best supported by American and English decisions may be said to divide all merchandise into three classes. Of these classes, the first consists of articles manufactured and primarily and ordinarily used for military purposes in time of war; the second, of articles which may be and are used for purposes of war and peace, according to circumstances; and third, of articles exclusively used for peaceful purposes.

"Merchandise of the first class, destined to a belligerent country, or places occupied by the army or navy of a belligerent, is always contraband; merchandise of the second class is contraband only when actually destined to the military or naval use of a belligerent; while merchandise of the third class is not contraband at all, though liable to seizure and condemnation for violation of blockade or siege." (The Peterhoff, 1866, 5 Wall. 28.) See Contraband of War.

A neutral may not trade with a blockaded port. The penalty for violation is the confiscation of the ship, which, if it escapes, continues liable to the end of the return voyage. The cargo will not be condemned if it belongs to persons other than owners of the ship unless such owners had actual or constructive knowledge of the blockade. See Blockade.

If belligerents may capture ships engaged in contraband trade and blockade-running, they must have the right to visit and search suspected merchantmen. This is, however, purely a belligerent right and neutrals must submit. Resistance to inspection or joining a convoy to escape visitation subjects the offending vessel to capture.

Unrecognized insurgents are technically speaking pirates, but if they confine their actions to the mother country, international law of the present day would not treat them as pirates. The *animus furandi* is lacking. See Piracy.

For the history of international law, see Wheaton, *History of the Law of Nations* (New York, 1845); Holtzendorff, *Handbuch des Völkerrechts* (Leipzig, 1880; French trans. 1888); Walker, *History of the Law of Nations* (London, 1899). The best English treatise is *Hall's International Law* (London, 1895). See also Wheaton, *Elements of International Law* (8th ed., Dana editor, Boston, 1866), a classic; Halleck, *International Law* (3d ed., Baker ed., New York, 1893); Woolsey, *International Law* (6th ed., New York, 1891); Kent's *Commentaries* (14th ed., vol. i., pp. 1-200, Boston, 1896), are excellent manuals. More comprehensive works are: Phillimore, *Commentaries on International Law* (3d ed., London, 1879-1889); Twiss, *The Law of Nations* (London, 1861), preferably in the French translation (Paris, 1887-1889). The best short work in French is Bonfil's *Manuel de droit international public* (3d ed., Fanchille ed., Paris, 1901); Calvo, *Droit international* (5th ed., Paris, 1896), the best comprehensive French treatise; Rivier, *Principes du droit des gens* (Paris, 1896). The classic German work is Heffter, *Das Europäische Völkerrecht der Gegenwart* (8th ed., Geffken ed., Leipzig, 1888). The best short treatises are Rivier, *Lehrbuch des Völkerrechts* (2d ed., Leipzig, 1899), and Liszt, *Das Völkerrecht* (2d ed., Leipzig, 1902). The most comprehensive and authoritative work in German is Holtzendorff, *Handbuch des Völkerrechts*, mentioned above.

INTERNATIONAL PEACE CONFERENCE. A conference of one hundred and one delegates representing twenty-six countries of the world, held at The Hague from May 18 to July 29, 1899. It was convened in pursuance of an invitation addressed by the Czar of Russia to the governments of the principal civilized States of the world with a view to concerted action with regard to certain international questions of peace and war, and with a view of securing, if possible, a gradual reduction of the military and naval armaments of the States represented. See Hague Peace Conference.

INTERNATIONAL PRISON CONGRESS. The first prison conference was held in 1845 at Frankfort, followed by a second in 1857. These were largely attended by Europeans. After this, local associations were formed, but no international convention held. Count Sollenhub, of Russia, suggested to Dr. E. C. Wines, Secretary of the New York State Board of Charities, that the board call a congress. This was not deemed advisable, but shortly thereafter (1870) the first American prison congress was held, and President Grant was influenced to appoint Dr. Wines commissioner to arrange an international conference. The congress met in London in 1872. Meetings are now held at intervals of five years, the last having been at Brussels in 1900. The programmes are arranged by a permanent committee, the International Penitentiary Commission. Papers by experts are printed in advance, and form the bases of the discussions. French is the language of the meetings and of the reports and bulletins. The report of the London congress is in English. The congresses have been held in various capitals, and have been productive of great good. Consult *Bulletins* and *Reports* of the Congress.

INTERNATIONAL TRADE. Trade between nations or between distant regions has been a fruitful source of discussion among economic writers, and a subject which has often engrossed governmental attention to the exclusion of internal commerce, though it is a familiar fact that in modern times internal commerce is far more important to the welfare of the State. This apparently undue prominence in discussion and legislation was due not only to the fact that international trade caught the eye of the observer, while domestic trade withdrew itself from observation, but also to the fact that in early economic life foreign trade, as compared with home trade, was far more significant than it is in modern times.

This greater relative importance of international trade in its historical beginnings was due to the slight division of labor in the older economic order, and to the relatively small areas of States. The soil of the neighborhood produced what was necessary for the simple wants of the inhabitants. Towns were rare and small, and artisans few in number. Most of the inhabitants were agriculturists, whose most pressing needs for manufacturing products were satisfied by the produce of the household. In short, the satisfaction of daily wants did not give rise to a 'home trade' such as characterizes modern industrial society. To the uniformity of economic organization must be added the difficulty of internal communication as an obstacle to the development of any considerable interchange of commodities. Navigable rivers furnished the only means of internal transportation which were not attended with prohibitive costs. Only those nations with a favorable seacoast could develop any considerable commerce, and, with it, that diversification of industrial pursuits upon which domestic trade rests. We may, therefore, say that foreign trade preceded domestic trade.

If we except the period of the Roman Empire, when such trade as existed became internal trade, because the known world became, as it were, one nation, the division of sovereignty before modern times was so great that most trade was foreign rather than domestic. When petty principalities or provinces of the same realm enjoyed their own customs regulations, much trade was 'foreign' which in modern times would be domestic.

Largely to these considerations, as well as to the more showy character of foreign trade, its spectacular and romantic character, does this trade owe its prominence in economic discussion and in the attention of governments. Moreover, as such trade came into early notice as a means of raising revenue for the State, it thus became a matter of public concern.

It cannot be claimed that the contradictory and vacillating practice of mediæval rulers developed any well-defined theory of foreign trade. It is not until after the discovery of America and the commercial awakening that followed the influx of the American silver that the beginnings of a theory of trade appear in the writings of pamphleteers who have since been designated as the mercantile school. Thomas Mun, in his work upon *England's Treasure by Foreign Trade* (1664), states in a few words the wisdom of his time. "The ordinary means to encrease our wealth and treasure is by *Forraign Trade*, wherein wee must ever observe this rule: to sell more to strangers yearly than wee consume of theirs in value. By such a course the balance must be paid in coin, and the country enriched, while a contrary course would deplete its stock of the precious metals." The confusion of wealth and money is obvious, and characterizes the whole thought of the period. As we shall see, it led to some extraordinary governmental measures to promote the flow of gold and silver into the nation and to check its outflow. It distorted the economic policy of the nations for generations, and threw the entire public interest in foreign trade upon its capacity to attract specie. It carried with it the corollary that importations should be limited as far as possible, and caused vexatious restrictions, high import duties, and frequent prohibitions of the importation of foreign commodities. Thus, in 1674 the total prohibition of the importation of French brandy was advocated in England, not only to encourage the consumption of domestic ale and beer, but also because it was considered undesirable to increase the consumption of French goods. Writings upon trade subjects are full of fears lest any nation should sell more to England than it bought from her, and the Government was repeatedly urged to take measures against any nation which so offended against public policy. All writers did not, however, share this shortsighted view, and Mun stands out from his contemporaries by his perception that what is apparently lost by trade with one nation may be the means of gain, since the goods imported from it may be disposed of at great profit to some other nation. He is none the less quite convinced that the aggregate of exports and imports should show a decided balance in favor of the former. Another characteristic of the time is the preference given to trade in distant parts, as when Mun says: "Also wee ought to esteem and cherish those trades which wee have in remote or far countreys, for besides the encrease of shipping and mariners thereby, the wares also sent thither and received from thence are far more profitable unto the kingdom than by our trades near at hand." The great profits secured by those States which came to be depots of the Indian trade doubtless led Mun to take this view.

To these writers the entire advantage of foreign trade lay in exportation. Importation was at best a necessary evil. So far as individuals were concerned, it is true, the volume of business of both kinds was the measure of profitableness, and traders were prone to encourage all commerce; but from the standpoint of the kingdom as a whole that trade was regarded as profitable which resulted in an importation of specie.

The Physiocrats (q.v.) riddled the pretensions of these writers, and held up this policy to derision. Adam Smith demonstrated still more conclusively the weakness of their doctrine. He did not feel it necessary to insist that money and wealth were not synonymous terms, that an increase in the former was not the sole goal of statecraft. In his day England's stock of the precious metals was adequate to its needs, and was therefore not a subject of peculiar solicitude for the statesman, as it had been in earlier times. Adam Smith states in the following terms the advantages to different countries of international trade: "It carries out that surplus part of the produce of their land and labor for which there is no demand among them, and brings back in return for it something else for which there is a demand. It gives a value to their superfluities, by exchanging them for something else which may satisfy a part of their wants and increase their enjoyments. By means of it the narrowness of the home market does not hinder the division of labor in any particular branch of art or manufacture from being carried to the highest perfection. By opening a more extensive market for whatever part of the produce of their labor may exceed the home consumption, it encourages them to improve its productive powers and to augment its annual produce to the utmost, and thereby to increase the real revenue and wealth of the society." Trade enables a nation not only to obtain what it cannot produce itself, but also to carry its own production to the highest degree of perfection by reason of this outside demand. The advantage of trade lies in its effect upon home industry, and trade is represented as a mutual and not as a one-sided advantage. The home market is now recognized to be the most important, and foreign trade as subsidiary to it, as significant only in so far as it promotes a better division of labor and more productive employment of capital at home. The emphasis is shifted from the purely mercantile side, and the question shown to be a much larger one than a mere increase or decrease of specie.

If the mercantilists insisted that the entire advantage of foreign trade lay in exportation, while Adam Smith deemed the advantage mutual, later writers—as, for instance, John Stuart Mill—have gone so far as to declare that the importance to the nation of its international trade was measured by its imports. This is not, of course, a mere reversal of the mercantilist attitude, for the distinguished economist is far from contemplating the possibility of imports without corresponding exports. But to him the imports of a nation represent a saving of energy, time, labor, and capital in the acquisition of goods. While the same goods, or many of them, could doubtless be produced at home, it would be at far greater expenditure of effort than that involved in producing the goods exported to pay for them. In following the history of economic thought on the subject of trade, we have passed from the period of a crude but ultra protectionism to one of free trade.

In the meantime new questions have arisen which call for attention. It needs no expert to perceive the advantage of trade between temperate and tropical countries. But in the trade of temperate countries among each other the advantage is not so apparent. It may, and does, happen that a country will import from another a commodity which it can produce at home at less labor cost than is expended upon its production in the country whence it is imported. If such is the case, it is clear that production does not always take place at the point of maximum advantage. It is assumed that within a given country production is carried on at the point of greatest advantage, because of the mobility of capital and labor. But between different nations there is not such perfect mobility, and production continues under varying circumstances of advantage and disadvantage. In domestic trade the costs of production, as a rule, determine prices and values; but in international trade there must be another rule. If England can produce a commodity A with 10 units of productive power, while a foreign country requires 12 units for the same commodity, England may buy of the foreign country, but certainly will not pay 12 units for the goods. The first question which arises is, Why does not England in these circumstances produce the commodity A? Simply because in the production of other commodities B, C, D, etc., it enjoys still greater advantages over foreign countries. Its maximum productivity is gained by concentration on these other lines of production. In the case mentioned the costs of production for England and the foreign country may be stated as follows for like quantities of each commodity:

A.	England	10	units,	the	foreign	country	12	units.
B.	"	9	"	"	"	"	13	"
C.	"	8	"	"	"	"	14	"
D.	"	7	"	"	"	"	15	"

It is clear that it will be profitable for England to produce B, C, D for its own wants, and so much in excess thereof as it can persuade the foreign country to take, while it will pay the latter to concentrate its production upon A and supply so far as possible its needs for B, C, and D by importations from England. This shows the motive for an international trade under these circumstances. There is a further question as to the rate at which these articles will be exchanged.

INTERNATIONAL VALUES. As in the illustration given, it is obvious that England will not pay the foreign country 12 units for A when it can produce A at home for the expenditure of 10 units, the question is how much the foreign country will obtain. If the demand in England for A is equal to the demand of the foreign country for D, the exchange will take place between those commodities. England will get its supply of A at the cost of producing D; the foreign country will get its supply of D at a cost of 12 productive units instead of 15 productive units. The advantages of the trade are obvious, and the total production of the two countries concerned is greatly increased. If there was no demand in the foreign country for D, but on the other hand a large demand for C, the trade might be between those commodities, and the advantage, though less, might still be considerable. These simple illustrations allow us to state the rule of international value. It is that in international trade the price paid for the foreign article does not follow the costs of production of that article in the country in which it is produced, but rather the costs of production of the article exported in exchange for it. This rule is stated only as a tendency. Economists have devoted considerable attention to the actual equation of exchange. A single modification of the foregoing illustration will indicate the infinite variety of circumstances which modify in practice the tendency stated. Let us suppose that England needs a larger quantity of the commodity A than the foreign country does of D. To stimulate the demand for D, it must be offered at a lower price. So that on the new basis by the exchange of the produce of 11 units of productive power the foreign country gains the same goods as before. Its advantage in the acquisition of D is therefore 15 units —11 units, or 4 units. On the other hand, England has gained a quantity of A corresponding to the expenditure of 9 units of her own productive power; her gain by the exchange is no longer 3 units, but only 2. In this manner an infinite variety of circumstances, such as cost of carriage, customs, exchange, may be introduced to modify the conditions of the problem.

It is not to be overlooked that the necessity for a special theory of international trade and of international values has been broadly denied by some writers. They claim that as nations as such do not trade with one another, but only the individuals which compose them, there is no real distinction between the trade of individuals in one country and those of two different countries. They point out further that there are often within the same country regions more widely separated and in less intimate relation with one another than are two foreign countries. To this criticism it is objected that the word nation is retained in this discussion for convenience merely, and that while the economic characteristics involved—namely, a lack of mobility of capital and labor—are most pronounced between regions under different governments, laws, customs, languages, and monetary systems, it may be conceded that under the same national Government there may be regions which possess the same economic isolation from one another. This does not destroy the theory, but only enlarges its application.

We may turn now from the attitude of the economists to that of the public authorities.

HISTORY OF INTERNATIONAL TRADE. It has already been pointed out that the earliest trade was between widely distant nations rather than contiguous ones; that in the entire period which preceded the nineteenth century trade between different countries rested upon a pronounced difference in their products, rather than on such slight advantages of comparative cost as in modern times. Fundamental, moreover, for an understanding of the course of earlier trade is a proper appreciation of the costs of carriage and of the legal obstacles to trade imposed by the governments. These considerations affected in a high degree trade by land, and in lesser measure that by sea and along the navigable rivers.

The great physical contrast upon which early trade was founded was that of temperate and tropical countries, which in historic times was the contrast of West and East. This physical contrast was enhanced by a distinct historical development of the two regions, by the earlier progress of civilization and the arts among the people of the Orient. Hence a large part of the history of commerce is the history of trade with the East. The first trade routes were overland from Central Asia to the Mediterranean, whence the goods were carried by Phœnician and later by Greek traders to all parts of the Mediterranean Sea. In view of the heavy costs of transport, the goods which were so traded were of the richer sort—spices, silk, embroideries, fine linens, and the finer manufactures of the metals—sword-blades, gold and silver utensils, and precious stones. To the difficulty of transporting the goods was added the difficulty of protecting them, which again forbade the commerce with bulkier commodities, whose size would be an embarrassment. Protected by the power of Imperial Rome, this commerce extended as far as India and China, while Egypt was the granary of the Imperial city, whence it drew its supplies of grain.

But with the break-up of the Roman power commerce declined. Constantinople, indeed, maintained its relations with the East, and at a later period the Arabs, who controlled the Southern Mediterranean from Egypt to Spain, and had a firm footing in Sicily, carried on a considerable trade. But the Roman civilization on the Rhine, in Britain, and in Gaul, which had brought those countries into close connection with the Oriental world, had been destroyed, while Goths and Lombards subjected Italy to a ruder civilization than it had heretofore known. It was, however, in the Italian Peninsula that commerce first arose in the Middle Ages. Venice, Genoa, Pisa, and Florence took up the trade between the East and the West, which in classic times had been in the hands of Greeks and Phœnicians. They claimed rights of trading at Constantinople among the Arabs. These pretensions were supported by the naval power of the State, which protected the ships of its merchants. They carried the produce of the East and of Italy through the Strait of Gibraltar to Flanders and the Hanseatic towns. At the outset of this new development of maritime commerce it was harassed by pirates, but the strong hand of Venice put down this nefarious practice in the Mediterranean Sea, as the Hanseatic League crushed the Danish sea-robbers.

But these marauders of the sea could not be utterly suppressed, and they made maritime ventures extremely hazardous to a late day. Hence, just as the Eastern merchants sought the protection of the caravan, so the Western merchants sought the protection of the flotilla. Hence the habit of sending off expeditions of merchantmen under the protection of men-of-war, which made of foreign trade a matter of State concern rather than of private enterprises. Only those who could secure such protection could afford to engage in these enterprises. In the first instance, as in Venice, these were the grandees, who were themselves the political power; but in later instances such privileges were conferred upon the great commercial companies, on whom was conferred also a monopoly of trade.

With the advent of the Turks in Asia Minor and the final conquest of Constantinople, the old paths to the East were closed and the supremacy of the Italian States was doomed. New paths were sought to the East—Vasco da Gama discovered the passage to India around the Cape of Good Hope, and in a like quest Columbus revealed to Europe the Western Hemisphere. Portugal, Spain, Holland, England, in turn, succeeded to the commercial leadership. Commerce with these distant lands was not made free to all, but given over to the great commercial companies, of which the East India companies of Great Britain and Holland were the most conspicuous for their enduring results, the Mississippi Company in France and the South Sea Company in England most famous for their spectacular failure.

While the European nations willingly lent the aid of the Government to commerce in distant lands, they were far from encouraging intercourse with their neighbors. In 1626 Louis XIII. of France prohibited all commerce with England. Before long commerce was again renewed, but hostile tariff legislation was the order of the day, in spite of commercial treaties concluded in 1632. In 1649 the Commonwealth, in retaliation for high-handed proceedings in France, prohibited the importation of French wines, wool, and silk, though this prohibition was again removed by a treaty of 1654. In 1678 there was again a prohibition of importation of French wines and brandy, and for a quarter of a century ill feeling prevailed, which finally found expression in 1703 in a treaty with Portugal, which gave the wines of that country a decided preference over those of France. This illustration of the relations of the countries in a single century is characteristic of the time. Such prohibition of trade was dictated by the mercantile policy before described, which at an earlier stage had sought its ends by the even cruder methods of forbidding, under severe penalties, the exportation of bullion, and had even sought by a high rating of foreign coins to attract them to the Kingdom.

Of the various restrictions upon and encouragements to foreign trade, which little more than a century ago were so generally in vogue, prohibitive import duties, export duties, and export bounties, one only is of far-reaching significance to-day—duties upon imports. For the various questions to which they gave rise in their modern aspects, see COMMERCE; CUSTOMS DUTIES; FREE TRADE; PROTECTION; TARIFF; MERCANTILISM.

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INTERNODE (Lat. *internodium*, space between knots, from *inter*, between + *nodus*, knot). In botany, the portion of stem between two successive nodes (joints). It is the internodes which give length to the stem and stretch the nodes apart. The leaves and branches are borne at the nodes. See STEM.

INTEROCEANIC SHIP CANAL. See CANAL; NICARAGUA CANAL; PANAMA CANAL.

INTEROCEANIC SHIP RAILWAY. See SHIP RAILWAY.

INTERPELLATION. A method of European legislative procedure, whereby members of the legislature interrogate the Ministers in regard to the policy and measures of the Government. Its primary purpose is to force the

Chamber to pass judgment upon the policy of the Cabinet. This form of interrogating the Ministry occupies an important place in the parliamentary procedure of France and Italy, and is also occasionally resorted to in other Continental countries of Europe which have a purely parliamentary form of government. Any member of Parliament is free to bring forward an interpellation without regard to the wishes of the Ministry. The legislative body fixes the day on which the Ministry are to be interpellated on a given subject. The Ministers then prepare their answers and make ready for a defense of their policy against the expected attack. Any member may reply to a Minister, and a general debate may follow, as well as motions which may result in the resignation of the Ministry. In France, of about twenty Ministries which have resigned in consequence of an adverse vote in the Chamber of Deputies, ten have done so on account of motions growing out of interpellations. Interpellations arouse more general interest than the debates on important measures, and one of the chief sources of a Minister's strength is his skill in answering them. Ministers are not, however, obliged to answer interpellations when such an answer might prove prejudicial to the public interest, as in the case of diplomatic negotiations. It often happens that the Ministry is glad to be interpellated, as a full disclosure of the Government's policy may strengthen its position in the estimation of the Chambers.

In Italy the method of interpellation exists in substantially the same form as in France. The rules of the Imperial German Reichstag also provide for interpellations; but since the Chancellor, to whom they are in theory addressed, has no seat in the Reichstag, and never resigns on account of legislative disapproval, the interpellation is of litile significance in German parliamentary procedure.

INTERPLEADER. An equitable remedy, available to a person against whom two or more persons claim the same thing, debt, or duty, and who is, without his own fault, ignorant or in doubt as to which is the rightful claimant. It was first used in England to enable a depositary or bailee of deed in escrow of whom the grantor and grantee each demanded delivery of the deeds to himself (one affirming and the other denying that the terms or conditions had been complied with) when sued by either to recover possession of the deeds, to apply to the court for an order compelling the other claimant to appear and be substituted as defendant in his stead. This relief was all that could be granted by a court of law, and was originally confined to the above class of cases.

The idea was taken up by the courts of equity, and was extended to cover claims of every nature, where the demands were identical. It became the practice to permit one who was harassed by two claimants demanding the same thing, debt, or duty, to file a bill or pleading in equity setting forth the facts and praying that the parties be compelled to interplead, that is, to contest their claims before the court between themselves, and that the court decree which of them was justly entitled to the matter in controversy. This was permitted irrespective of whether actions had been commenced or not. In this form the remedy exists in modern practice. The pleading by which the complainant brings the matter before the court must set forth the following facts: (1) That two or more persons make a claim against him; (2) that they claim the same thing, debt, or duty; (3) that he has no beneficial interest in the thing or obligation claimed; and (4) that he cannot determine without hazard to himself which is the rightful claimant. He must also show by affidavit that he is not in collusion with either party, and must allege his willingness to perform his obligation to the proper party. He must, therefore, be entirely indifferent as to which claimant succeeds; in other words, be in the position of a stakeholder. Very abstruse questions of law often arise as to whether the parties are demanding the performance of the same obligation. For example, if a landlord and a person claiming title from an entirely different and independent source, both demand rent from a tenant, he cannot compel them to interplead, as he is under a duty to his landlord not to dispute his title. However, if a person claiming to have derived his title from or through the landlord by purchase or otherwise and the landlord himself both demand rent, the tenant has grounds for relief, as they demand the same obligation, and he does not thereby dispute his landlord's original title.

The relief will not be granted where it appears that the applicant knows or should know which of the claims is just, but if there is a reasonable doubt, and he would be running a personal risk to decide between them, with the means of knowledge at his command, it is the settled practice to allow the remedy. See EQUITY; PLEADING; and consult the authorities there cited.

INTERPOLATION (Lat. *interpolatio*, from *interpolare*, to alter, from *interpolis*, *interpolus*, altered, from *inter*, between + *polire*, to polish). In mathematics, the process of finding terms intermediate between given terms of a series. From the law of the series, the values of the intermediate terms may be computed, but it is often sufficient for practical purposes to approximate the intermediate terms by assuming a simpler relation. E.g. given $\log 80 = 1.9030$, and $\log 90 = 1.9542$. The logarithm of 85 is approximately obtained by adding to 1.9030 one-half of the difference between 1.9542 and 1.9030, although the logarithms are in arithmetic progression only when the numbers are in geometric progression. The method of interpolation is not only of use in pure analysis, but it is particularly valuable in problems of astronomy, and other sciences, often saving laborious calculation. Thus, the position of the moon for any hour may be determined by interpolation from its computed positions for every 3, 6, or 12 hours, with sufficient accuracy for practical purposes. Methods of interpolation for astronomical problems are found in Lagrange's memoirs of 1783, 1792, 1793.

INTERPRETATION (Lat. *interpretatio*, explanation, from *interpretari*, to explain, from *interpres*, agent, interpreter), or CONSTRUCTION. The process of ascertaining, subject to the rules of law, the meaning of a speaker or a writer, or of parties to a legal instrument, as expressed in the spoken or written terms. Some authorities distinguish construction from interpretation; using the latter term to describe the process of finding out the true sense of any form of words, and applying the former to the process of ascertaining the legal effect of those words. According to these authorities, "the office of interpretation is analytic, that of construction is synthetic; the office of the one is to get at facts, that of the other to group these facts and determine their legal meaning; interpretation is exploration, construction is induction." Or to put the distinction in another way, interpretation gives us the grammatical and logical signification of the words and sentences under consideration; while construction gives us their legal effect by "the familiar judicial process of applying the law to the facts of the case." This distinction has not generally commended itself to the courts either of England or of this country, and is ignored or deliberately discarded by most systematic writers upon law. It will not be observed in the further discussion of this topic. The terms will be used interchangeably, as denoting the process of ascertaining the true import of a document having legal consequences. Interpretation, as a separate branch of law, has its origin in the imperfections of language and the limitations of human thought and understanding. How imperfectly and even bunglingly the average man expresses himself, not only in hurried memoranda, but in formal documents as well, is evidenced by the vast number of lawsuits brought to settle the meaning of such documents.

The legal process of interpretation is required, not only because of confused thinking and obscure language on the part of speakers and writers, but because of the frequent misapprehensions of hearers or readers, due to mental limitations. If a writing has legal consequences; for example, if it is a constitution, or treaty, or statute, a will, a deed, or a contract, or if it contains an attack upon reputation or a right of property, provision is needed and has been made for determining which of various interpretations shall prevail. Speaking generally, that determination rests with a court of justice, in a legal action properly brought before it for hearing and decision. If the form of words whose meaning is in doubt is a public writing, such as a provision of a statute, treaty, or constitution, the question of construction belongs exclusively to the judge. If it is a private writing, such as a contract, will, or deed, having peculiar expressions in it which have, in particular places or trades, a known meaning attached to them, it is for the jury to say what the meaning of those expressions is; but it is the function of the court to construe the instrument after this ascertainment by the jury of the true meaning of such peculiar expressions. This legal rule is due in part to the fact that in olden times, when law was in its formative stage, jurors were frequently unable to read or write; but in part, also, and perhaps more largely, to considerations of policy. A learned English judge once declared that unless this rule was followed "there would be no certainty in the law; for a misconstruction by the court is the proper subject, by means of a bill of exceptions, of redress in a court of errors; but a misconstruction by the jury cannot be set right at all effectually." The rule has been supported by a distinguished legal writer upon other grounds of good sense and expediency. It is important, he remarks, that "most writings brought under judicial consideration should have a fixed meaning; should not be subject to varying interpretations; should be construed by the tribunal which is most permanent, best instructed, most likely to adhere to precedents." While the construction of a writing is ordinarily for the judge, and not for the jury, libel cases form an exception to the rule. Whether a particular writing is such an attack upon reputation as to amount to a libel is for the jury to decide. In other words, the jury, and not the court, construe a writing which is alleged to be defamatory. Such at least is the doctrine in England in all cases of defamation, and in this country in all criminal prosecutions for libel.

It is to be borne in mind that the object of interpretation is not to discover the intention of parties to a transaction by the use of any and every legitimate means. Its purpose is much less ambitious; its scope much narrower. The problem for the interpreter is this: given certain language in which persons have professed to state their intention in a particular matter, what is the intention thus stated? It may be that the parties have used language so carelessly that it fails to express any definite intention. In such a case interpretation is fruitless. It must stop short of accomplishing its object for want of materials. "All latitude of construction," said Chief Baron Eyre in an oft-quoted decision, "must submit to this restriction; namely, *that the words may bear the sense* which by construction is put upon them. If we step beyond this law, we no longer construe men's deeds, but make deeds for them." It is not the office of interpretation, then, to add anything to the text of a writing. Its function is only to discover and set forth what is in it. But a question arises at this point, upon which the authorities are not entirely in accord: What is to be deemed within and what without the text? It is sometimes said that judges and writers in answering this question range themselves in two schools of interpreters: a liberal and a literal school. The former declare that everything is in the text which a mind fully informed as to the circumstances in which the writing was made, "and doing no violence to the rules of language and the rules of construction, may reasonably find there." The latter insist upon limiting interpretation to the meaning of the text itself. Perhaps no better statement of the prevailing view on this point has been made than the following: "Interpretation is a process of reasoning from probabilities, a process of remedying by a sort of equitable jurisdiction the imperfections of human language and powers of using language, a process whose limits are necessarily indefinite, and yet continually requiring to be practically determined. It is not a mere operation requiring the use of grammar and dictionaries, a mere inquiry into the meaning of words."

So far as legal interpretation does make use of the rules of grammar and the laws of language, it does not differ from the process employed by every educated and intelligent listener or reader when engaged in discovering the meaning of a speaker or writer. Any legal rules, however, are peculiar to judicial interpretation. Some of them owe their existence to peculiarities of legal procedure; but most of them have been evolved by the courts with a view to producing greater uniformity in the terms of legal writings, or to lessening and shortening litigation, or to securing consistency in the judicial process of construction.

Some of the most important of these rules may be stated briefly as follows: (1) When the language of a writing is plain and unequivocal, there is no opportunity for interpretation. Even though the court may believe that the language does not express the intent of the writer, it will not force upon words a meaning which they cannot fairly bear. When words admit of but one meaning, to put another upon them is not to construe a writing, but to alter it. In case of a statute, it is not to interpret a law, but to make one. (2) The grammatical and ordinary sense of words is to be adhered to, unless that would lead to some absurdity, or some repugnance or inconsistency with the rest of the instrument, in which case the grammatical and ordinary sense of the words must be modified, so as to avoid that absurdity or inconsistency, but no further. Eminent English judges have called this the golden rule of construction. It is a corollary from this rule that when it appears, either from the instrument itself or from the circumstances attending its origin, that certain words are used in an abnormal, or peculiar, or technical sense, they shall be interpreted in such sense. Many modern statutes contain an interpretation clause in which the legislature carefully explains the exact meaning which is to be ascribed to certain important terms of the text. It is a helpful expedient for remedying to some extent the ambiguity of ordinary language. In England a general Interpretation Act was passed in 1889 (52-53 Vict., ch. 63) with a view to clearing up obscurities in existing and future statutes. (3) In construing any part of a writing, regard should be had to the entire instrument. Other portions may throw much light upon the one under special investigation, and greatly modify the meaning which it would bear as an independent clause. Every part of a writing should be brought into action in order to collect from the whole one uniform and consistent purpose, if that is possible. Accordingly, if one construction will give reasonable effect to every part of an instrument, while another would require the rejection of a part, the former will be preferred. (4) In the case of private writings, such as contracts and deeds, the language is to be construed most strongly against the party who is responsible for its use. Of course, this applies only to cases of ambiguity either in the words themselves or in their legal effect. Even then it will be enforced only when other rules of construction fail, for it is deemed somewhat harsh and rigorous. (5) As between constructions otherwise equally balanced, preference is to be given to that which renders the instrument most fair and just and reasonable. (6) In construing doubtful language, the court is entitled to consider all the circumstances connected with the origin of the instrument. Proof of these circumstances is not excluded by any rule of evidence (q.v.). It is not offered to contradict or vary an instrument, but to put the court, as nearly as possible, in the place of the parties at the time they agreed upon this language as the formal expression of their intentions. (7) The construction put upon an ambiguous instrument by the acts of the parties is entitled to great weight.

The literature upon this subject is quite extensive, although far from satisfactory. Most of the treatises are limited to special topics, such as constitutions and statutes, contracts, deeds, wills, and are confined mainly to an exposition of the art rather than to the science of interpretation; they state the practical rules for the construction of various classes of writings, rather than discuss the principles on which the process of interpretation should rest. The best theoretical treatment of the subject is found in Lieber, *Legal and Political Hermeneutics* (Hammond ed., Saint Louis, 1880); Hawkins, *Principles of Legal Interpretation*, 2 Juridical Society Papers (London, 1860); Thayer, *Preliminary Treatise on Evidence*, chapters v. and x. and Appendix C (Boston, 1898). Among the latest and most valuable practical treatises are the following: Beal, *Cardinal Rules of Legal Interpretation* (London, 1896); Black, *Construction and Interpretation of Laws* (Saint Paul, 1896); Hardcastle, *Rules which Govern the Construction and Effect of Statutory Law* (London, 1900); Maxwell, *Interpretation of Statutes* (London, 1896); Sedgwick, *Statutory and Constitutional Law* (New York, 1874); Sutherland, *Statutes and Statutory Construction* (Chicago, 1891); Jones, *Construction of Commercial and Trade Contracts* (New York, 1886); Elphinstone, Norton and Clark, *Rules for the Interpretation of Deeds* (Philadelphia, 1889); Hawkins, *Interpretation of Wills* (Philadelphia, 1885); Wigram and O'Hara, *Interpretation of Wills* (New York, 1872).

INTERPRETER, MR. A character in Bunyan's *Pilgrim's Progress*, typifying the Holy Spirit.

INTERREGNUM (Lat., period between reigns), THE GREAT. The name given to the period of German history between the death of Conrad IV., in 1254, and the election of Rudolph of Hapsburg, in 1273. It is often called the age of 'fist law' (*Faustrecht*). During this time Germany had no ruler who was generally recognized. William of Holland had been elected as an anti-king, in 1247, by the opponents of Frederick II. (q.v.). After Conrad's death William, with the aid of the confederation of Rhenish cities, succeeded in restoring order in a portion of Germany. His death, in 1256, led to greater confusion. Some of the electors, in 1257, chose Richard of Cornwall, the brother of Henry III. of England; the other electors chose Alfonso X. of Castile. Richard spent but little time in Germany; Alfonso never visited it. Neither one acquired any real power, and neither was crowned Emperor at Rome. When Richard died, in 1272, Alfonso's claims were set aside by common consent, and the Pope ordered the electors to proceed to a new election. This resulted (1273) in the choice of Rudolph. One of his first acts was to annul all laws passed by the rival kings since the death of Frederick II., in 1250. For this reason the Great Interregnum is sometimes made to include the years between 1250 and 1273. Consult Kempf, *Geschichte des deutschen Reiches während des grossen Interregnums* (Würzburg, 1893).

INTERROGATORIES (from Lat. *interrogatarius*, consisting of questions, from *interrogare*, to question, from *inter*, between + *rogare*, to ask). Questions in writing prepared for the examination of one or more witnesses in a judicial proceeding, to be taken out of court.

In the English and American law interrogatories are commonly employed in the following classes of cases: Where the testimony of an aged or infirm witness is to be taken before trial, in order that it may be available in case of his death; where a witness is out of the jurisdiction, and it is desirable to obtain his testimony or deposition, as it is called; and in connection with a bill of discovery (q.v.) in equity. In the first two classes of cases the practice is for the counsel desiring the testimony to obtain an order, or commission, from the court, directing that the examination be taken before some officer competent to administer an oath, and then to prepare his interrogatories and submit them to the opposite party or his counsel, who may prepare cross-interrogatories. In some jurisdictions the legal competency of the questions is settled by the court before the examination, and in others the objections of counsel are noted at the time of the examination and ruled upon at the trial. The commission and the interrogatories are then forwarded to the designated officer, who summons the witnesses on the day fixed, administers the oath, propounds the questions, reduces the answers to writing and transmits them, together with the order and interrogatories, to the court out of which the commission issued. Such examinations are subject to all the rules of evidence.

Interrogatories are sometimes annexed to a libel (q.v.) in an action in admiralty, but this is not common practice. See DEPOSITIONS; EVIDENCE.

INTERSTATE COMMERCE. A phrase designating commercial transactions between persons in different States of the United States. The absence of power to secure uniformity in commercial regulations was a source of weakness in the Articles of Confederation and was one of the causes of the adoption of the Constitution. Power is conferred upon Congress by the Constitution (Art. 1, sec. 8, cl. 3) "to regulate commerce with foreign nations and among the several states and with the Indian tribes." It was early held by the Supreme Court in the case of *Gibbons* v. *Ogden* (9 Wheaton, 1) in which the Chief Justice Marshall elaborately discusses the clause that the subject of congressional action is not limited to regulating traffic, the mere buying and selling or interchange of commodities, but that it comprehends also the means of transportation, and that, therefore, acts of the New York Legislature granting to Robert R. Livingston and Robert Fulton the exclusive right of navigating the waters of that State with steamboats were void. Congress may exercise control over highways, railroads, and navigable waters whenever they form avenues for commerce not wholly within a single State. This authority extends to rivers wholly within a single State, if such river together with other bodies of water forms a continuous route for commerce to other States or to foreign countries. That the United States has such an interest in these highways that it may secure an injunction to prevent the obstruction thereof was held *In re Debs* (158 U. S. Reports, 564), decided by the Supreme Court in 1894. Congress has power to authorize or regulate the erection of wharves, piers, and bridges, and while, in the absence of Congressional action, the States may also make similar local regulations the authority of Congress is paramount. Congress may make provision as to the means of transportation in regulating the building, equipment, and registration of vessels, their transfer by sale or mortgage, and in prescribing rules for navigation and the qualifications of pilots and engineers. Similarly in the case of transportation by land between States, Congress may legislate as to the management of railway trains and the duties of employees thereon. By virtue of this power the Safety Act of 1893 was enacted, requiring the use of automatic couplers and continuous brakes upon railroads engaged in interstate commerce.

The carriage of passengers as well as of goods is held to be within the meaning of the clause, so that Congress may provide regulations for the security of passengers, and even the transmission of messages by telegraph or telephone comes under the national authority.

Congress has no right to interfere with commerce carried on wholly within a State or with the manufacture of goods. The statutory provisions enacted in 1906 for the federal inspection of animals before slaughtering, and of meat and meat products and the establishments in which meat and meat products are prepared, and for the destruction of such meat as is unsound or unfit for human food, are confined to establishments where the products are to be used in interstate or foreign commerce.

Congress cannot regulate contracts which merely relate to commerce. For this reason it has been held by the Supreme Court that fire, marine, and life insurance do not fall within the scope of interstate commerce, and this is a chief obstacle to the proposed federal control of insurance. It has been questioned whether the power to regulate commerce includes the power to prohibit it. The constitutionality of the Embargo Act of 1807, prohibiting all commerce with Great Britain and France, was sustained by the lower courts but never authoritatively passed upon by the Supreme Court. This Court however decided in 1903 in the Lottery Case (188 U. S. Reports, 321) that lottery tickets are objects of commerce and that their transportation could be prohibited. Four out of nine justices of the Court dissented from this decision.

The Sherman Anti-Trust Act, passed in 1890, is an important enactment under the commerce clause. It provides: "Every contract, combination in the form of trust or otherwise, or conspiracy in restraint of trade or commerce among the several States, or with foreign nations, is hereby declared to be illegal." While a combination relating merely to manufacture has been held not to be within the scope of this act, the statute is applicable where there are provisions in the agreement to destroy competition or enhance the price of articles upon sale between the States. The most important decision under this statute was that of the *Northern Securities Company* v. *The United States* (193 U. S. Reports, 197), in which it was held in 1903 by a nearly evenly divided court that a combination of stockholders of the Great Northern and Northern Pacific Railway Companies, to form the Northern Securities Company as a holding corporation to own the majority of the stock of the two railroad companies, was an illegal combination in restraint of interstate commerce.

For the provisions of the Interstate Commerce Act of 1887, as amended in 1906 by what is popularly known as The Railway Rate Bill, providing for the fixing by the Interstate Commerce Commission of rates for the transportation of persons or property, see RAILWAYS.

Congress is restricted in its power by being forbidden to lay any tax or duty on articles exported from any State (Constitution, Art. 1, sec. 10, cl. 5) and also by the provision that "no preference shall be given by any regulation of commerce or revenue to the ports of one State over those of another; nor shall vessels bound to or from one State be obliged to enter, clear, or pay duties in another." (Art 1, sec. 9, cl. 5.)

The power of Congress is exclusive of that of the several States wherever the matter regulated is of a national character or admits of or requires a uniform system of regulation, and in the absence of legislation it is to be presumed that Congress intended the common law to remain unchanged so that any State statutes on such subjects will be held void. A State cannot prohibit the exportation or importation of any article of commerce or the delivery within the State of such an article purchased without the State, nor can it impose a tax on the subject of sale of interstate commerce. A State cannot impose a tax upon immigrants, nor can a tax be imposed on a railroad upon freight brought within a State, nor can it levy a tax upon the gross receipts from the business of transportation with other States, for this is in effect a tax upon interstate commerce. It was held by the Supreme Court that the State of Iowa could not prohibit the sale of intoxicating liquors by an importer so long as such liquors remained in the original package and had not been mingled with the mass of property within the State. To counteract the effect of this decision the Wilson Act of 1890 was passed by Congress, providing that intoxicating liquors transported into any State shall upon arrival be subject to the laws of such State, enacted in the exercise of its police powers in the same manner as domestic liquors. Similar statutes have been enacted by Congress to render effective State laws as to game and oleomargarine. Consult Judson, *The Law of Interstate Commerce* (Chicago, 1905); Cooley, *Principles of Constitutional Law* (Boston, 1898).

INTERSTATE COMMERCE ACT. See RAILWAYS.

INTERSTATE COMMERCE COMMISSION. See INTERSTATE COMMERCE ACT.

INTERVAL (Lat. *intervallum*, interval, from *inter*, between + *vallum*, wall). In music, the difference of pitch between any two sounds, or the distance on the stave from one note to another, in opposition to unison, which is two sounds exactly of the same pitch. From the nature of our system of musical notation, which is on five lines and the four intervening spaces, and from the notes of the scale being named by the first seven letters of the alphabet, with repetitions in every octave, it follows that there can only be six different intervals in the natural diatonic scale until the octave of the unison be attained. To reckon from C upward, we find the following intervals: C to D is a second; C to E is a third; C to F is a fourth; C to G, a fifth; C to A, a sixth; C to B, a seventh; and from C to C is the octave, or the beginning of a similar series. Intervals above the octave are therefore merely a repetition of those an octave lower. A flat or a sharp placed before either of the notes of an interval does not alter the name of the interval, although it affects its quality; for example, from C to G♯ is still a fifth, notwithstanding that the G is raised a semitone by the sharp. Intervals are classified as perfect, major and minor. Perfect intervals are those which admit of no change whatever without destroying their consonance; these are the unison, fourth, fifth, and the octave. Intervals which admit of being raised or lowered a semitone are distinguished by the term *major* or *minor*, according as the distance between the notes of the interval is large or small. Such intervals are the third and sixth; for example, from C to E is a major third, the consonance being in the proportion of 5 to 4; when the E is lowered a semitone by a flat, the interval is still consonant, but in the proportion of 6 to 5, and is called a minor third. The same description applies to the interval of the sixth from C to A, and from C to A♭. The second and seventh are also distinguished as major and minor. If the upper tone of a major, or perfect, interval be raised, or the lower tone lowered a semitone, the interval becomes augmented; thus: c-e♯ or c♭-e. By lowering the upper or raising the lower tone of a minor, or perfect, interval by a semitone, a diminished interval results, thus: c-b♭♭ or c♯-b♭. Intervals are further distinguished as consonant and dissonant. Consonant intervals are those which can enter into the formation of a major or minor triad. They are the perfect unison, fourth, fifth, and octave and major and minor thirds and sixths. Thus, c, e, g, c′ (1, 3, 5, 8) and c, f, a, c′ (1, 4, 6, 8) are the tonic triads of C and F major, respectively; whereas, with the third and sixth (e, a) flattened, they are the tonic triads of C and F minor, respectively. Dissonant intervals are the major and minor seventh and all augmented and diminished intervals. Whenever they enter into a chord, that chord is a dissonance and requires resolution into consonance. The distinction between consonant and dissonant intervals is made according to the ratio of the number of vibrations between any interval and the fundamental tone. Consonant intervals satisfy the ear because of their simple ratios; dissonances give a feeling of unrest and desire for resolution because of their complex ratios. The mathematical relations of intervals are determined as follows: given the normal a′, which is produced by a string vibrating 870 times per second (see DIAPASON), the octave above is produced by shortening the string by half its length.

(a) CONSONANT INTERVALS		(b) DISSONANT INTERVALS	
Unison	1:1	Major second	8:9
Fourth	3:4	Minor second	15:16
Fifth	2:3	Augm. second	64:75
Octave	1:2	Major seventh	8:15
Major third	4:5	Minor seventh	5:9
Minor third	5:6	Dimin. seventh	75:128
Major sixth	3:5	Augm. third	512:675
Minor sixth	5:8	Dimin. fourth	25:32
		Augm. fourth	18:25
		Dimin. fifth	25:36
		Augm. fifth	16:25

The number of vibrations will then be doubled, or 1740. This establishes the ratio between the prime and octave of 1 : 2. A string producing e″ vibrates 1305 times. Thus the ratio between prime and fifth is as 780 : 1305, or as 2 : 3. The preceding table shows the ratios of the different intervals.

As the length of the vibrating string is in inverse ratio to the number of vibrations, the ratios of the above table need only be inverted to determine the length of the string for any given interval. See HARMONY; MUSIC.

INTERVENTION (Lat. *interventio*, interposition, a coming between, from *intervenire*, to come between, from *inter*, between + *venire*, to come). (1) An act or proceeding by which a person not originally a party to an action is admitted as such for the protection of a right or interest in the subject matter of the litigation, which will be materially affected by its determination. It has always been a well-established right under the civil law and was early introduced into the English procedure. In a few of the United States the right is confined to actions involving real or personal property, but in most jurisdictions no such limitation exists. A person may be thus admitted as a party plaintiff or defendant, by application to the court before the cause has proceeded to trial. See PLEADING; PRACTICE; PARTIES.

(2) In international law, the interference of one State in the affairs of another for the purpose of preventing injury to itself, or in behalf of some principle, person, or collection of persons. Intervention may assume several forms. Thus it may be by verbal note delivered to the ambassador of the country against which the grievance is held; it may be by official notes publicly declared; it may take the form of an international congress or conference; or, finally, it may result in armed interference. It is the last form which is generally understood when reference is made to acts of intervention. Notable instances of intervention have been the invasion of Holland by the Prussians in 1787 to restore to his old position the Stadtholder, who was a brother-in-law of the Prussian King; the interference of the Holy Alliance to thwart liberal movements, and restore absolutism in Spain, Naples, Sicily, and Piedmont in the early part of the nineteenth century; the interference of Austria and Prussia in behalf of Louis XVI. of France in 1791; and the intervention of France in Rome in 1849 to restore the temporal power of the Pope.

No general rule can be laid down to determine when intervention is justifiable. It is well settled that it is excusable as a measure of self-preservation. Thus, in Europe, the policy of interference in behalf of the balance of power has been quite common. Any European State may be restrained from pursuing plans of acquisition of territory. Europe is regarded as a confederacy of States, and the balance of power is the guarantee of national existence against the designs of the more powerful States. This principle is not violated by territorial aggrandizements, so long as the safety and liberty of neighboring States are not endangered. Notable instances of intervention under this head were that against Louis XIV. to prevent him from seating his grandson on the throne of Spain; the coalitions against Napoleon; the interposition of the four Powers in 1840 in favor of the Sultan against Mehemet Ali of Egypt; and that of France and England in 1854 to preserve the integrity of the Turkish dominions against the designs of Russia. Concerted action or intervention by the great Powers of Europe is sometimes resorted to in order to prevent a smaller State from following a particular line of conduct or to compel it to do a certain act. An instance of this form of intervention was the formal recognition of the independence of Belgium by the five great Powers in 1830, when that country emancipated itself from Holland. With the development of modern civilization, humanitarian motives are often appealed to as a justification for interference where cruelty is inflicted by despotism or religious intolerance. Such cases must be carefully scrutinized, for the danger always exists that they may cover ambitious projects for territorial aggrandizement. But interventions on the ground of humanity have under exceptional circumstances certainly a moral, if not a legal justification. Such was the intervention of Great Britain, France, and Russia in 1827, by which Greece was liberated from Turkey, and again in the interposition of the great Powers in 1860 to stop the persecution and massacre of Christians of the Lebanon. The most important recent instance of intervention is that of the United States in Cuba in 1898, which may be referred in part to humanitarian feelings aroused by the cruelties attending the insurrectionary struggle against Spanish authority, in part to the destruction of American property, and the menace to American interests resulting from the possible acquisition of the island by another foreign power. See INTERNATIONAL LAW, and the authorities there referred to.

INTESTACY (from Lat. *intestatus*, having made no will, from *in-*, not + *testari*, to make a will, from *testis*, witness). A technical term of the law to describe the state of a person who dies leaving property undisposed of by last will and testament. By the present law of England and the United States there is no restriction upon the right of testamentary disposition. This has not always been the case, however, the right of disposing of one's property by will without restriction being a comparatively late acquisition in the evolution of society. Indeed, in Scotland, Louisiana, Quebec, and other States whose legal systems are based on that of the civil law, the power of testation is still limited by the right of children of the testator or other natural objects of his bounty to take by inheritance a certain definite share of his estate. See INOFFICIOUS TESTAMENT.

Intestacy may be complete, as where a person leaving property dies without leaving a valid will; or it may be partial, where a will does not dispose of the entire estate of the testator, either intentionally or through the lapse of a legacy, or the illegality of a specific devise. In either event the property undisposed of by will passes by the operation of the laws of descent (q.v.) and distribution (q.v.) to the heirs or next of kin of the decedent. See HEIR; INHERITANCE; TESTAMENT; WILL.

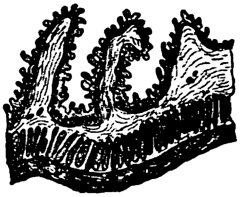
INTESTINE (Lat. *intestinum*, neut. sing. of *intestinus*, internal, from *intus*, within, from *in*, in). The part of the digestive tract between the stomach and the anus. The small intestine includes the duodenum, the jejunum, and the ileum, and averages 22 feet 6 inches in the male, 23 feet 4 inches in the female. With the exception of the duodenum, the small intestine lies in general in the central part of the abdominal cavity, bounded by the large intestine on either side and above. The jejunum and ileum are connected to the posterior abdominal wall by a reflexion of the peritoneum, called the mesentery. The duodenum is about 10 inches long, 1½ to 2 inches in diameter, and curved like a horseshoe. The head of the pancreas is received into the curve. It is the part of the intestine which is continuous with the stomach at its pyloric extremity. The jejunum is described under its title. The jejunum and ileum vary much in the arrangement of their coils, and there is little regularity in their position beyond that already stated. The term ileum is applied to the last three-fifths of the small gut. It ends at the ileo-cæcal valve, through which the contents of the small intestine escape into the head of the colon. The small intestine has four coats: Serous or peritoneal, muscular, areolar or submucous, and mucous. The last is covered with minute prolongations called 'villi,' and lined with columnar epithelium. There are few *valvulæ conniventes*, or folds of mucous membrane, in the ileum. Solitary glands alone or in aggregations (called Peyer's patches) are found in the lower part of the ileum. These are largely obliterated in typhoid fever.

The large intestine is divided into the cæcum; the ascending, transverse, and descending colon; the sigmoid flexure; and the rectum. It is so placed as to encircle the small intestine. The cæcum lies in the hollow of the right iliac region. From this point the colon rises to the liver, then crosses the abdominal cavity to the opposite side, passing below the stomach to the spleen; then, making a sharp turn, it descends to the left iliac fossa, where it forms a loop termed the sigmoid flexure (from its resembling the old Greek letter sigma); and finally, now termed the rectum, curves back to the head of the sacrum, thence follows the concavity of the sacrum, and thence curves backward to the anus. Attached to the cæcum, generally back of it, is a small, short, blind tube, about 3 to 4 inches long, opening into the gut, and termed the vermiform appendix (q.v.). The subdivisions of the large intestine are treated under their own titles. The constant motion of the intestine (peristalsis), by which its contents are conveyed along, is due to the contractions of the muscular fibres of the gut. See DIGESTION.

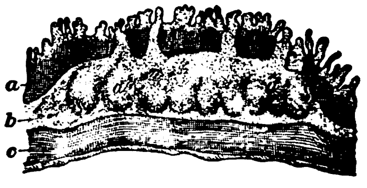
HISTOLOGY.

The wall of the intestine is composed of four distinct coats, which from without inward are known as: (1) The serous coat, (2) the muscular coat, (3) the submucous coat, and (4) the mucous coat or mucous membrane. These coats present certain differences in structure in the two main divisions of the intestine, the small intestine and the large intestine.

THE SMALL INTESTINE. The serous coat of the small intestine consists of a single layer of epithelium or endothelium (forming the peritoneal surface) resting upon a thin layer of delicate connective tissue. Beneath this lies the muscular coat composed of (a) an outer portion in which the smooth muscles are disposed longitudinally to the long axis of the intestines and consequently known as the longitudinal muscular coat, and (b) an inner or circular coat in which the muscle-cells are disposed transversely to the axis of the intestines. The two layers of muscle are separated by more or less connective tissue. The submucous coat consists of loosely arranged bundles of fibrous and elastic connective tissue, with a rich plexus of blood-vessels, lymphatics, and nerves. Through the submucous coat are distributed, at varying intervals, circumscribed masses of lymphoid tissue or lymph-nodules. These may occur singly (solitary glands, or follicles), lying in both submucosa and mucosa, and may even project slightly from the free surface of the mucous membrane. Or else, instead of a single nodule, there may be a collection of nodules forming what is known as Peyer's patches, which are found mainly in the ileum. Usually from 20 to 30 nodules constitute a patch. Like the solitary nodules, they lie in both submucosa and mucosa and often project upward to the free surface of the intestine. Finally, the mucous membrane of the small intestine is thrown up into transverse or oblique folds, which involve also the submucous coat, and which are known as the *valvulæ conniventes*. In addition to this the mucous membrane over the valvulæ is studded with minute projections known as villi, which are characteristic of the small intestine. The mucous membrane consists of three coats, the epithelial coat, the stroma, and the muscularis mucosæ. The epithelial coat is composed of a single layer of columnar epithelium, which covers the surface of the mucous membrane. Distributed at intervals among the columnar epithelial cells are clear, transparent cells, which, on account of their shape, are called goblet cells, or, because of their secretion, mucous cells. The epithelium rests upon a basement membrane, beneath which lies the stroma. The

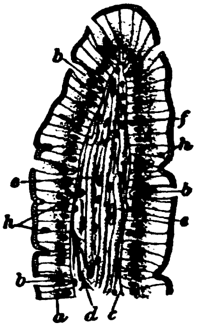


Longitudinal section of human small intestines, showing general relation of the folds constituting the *valvulæ conniventes* to the mucosa and submucous coat. The latter constitutes the fibrous core over which the mucosa with its villi and glands extends.



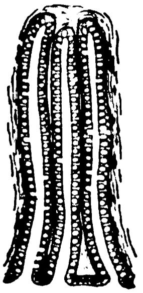
SECTION OF SMALL INTESTINE OF A CAT.

a, Mucous coat; *b*, submucous coat; *c*, muscular coat; *d*, *d*, Peyer's patch, cut crosswise.



Longitudinal section of villus from intestine of dog, highly magnified. a, Columnar epithelium containing goblet cells, *b*, and migratory leucocytes (*h*); *c*, basement membrane; *d*, plate-like connective tissue elements of core; *e*, blood-vessels; *f*, absorbent lymphatic radicle or lacteal.

latter is composed of delicate connective tissue and more or less diffuse lymphoid tissue. It extends up into the villi and supports the vessels, nerves, and glandular structures. From the bottom of the depressions between the villi, glands extend down into the stroma. These are tubular glands, called the crypts of Lieberkühn, and extend down almost to the muscularis mucosæ. The glandular epithelium is columnar in type, lower than that on the surface of the mucous membrane, with which it is directly continuous. Numerous goblet cells are distributed among the columnar cells. In one portion of the small intestine much more elaborate glands are found. They are situated in the duodenum and are known as the glands of Brunner. They are compound tubular glands, whose acini are situated in the submucosa and whose ducts pass up between the crypts of Lieberkühn and empty between the villi. The muscularis mucosæ is the innermost layer of the mucous membrane. It is composed of smooth muscle-cells, whose long axes correspond mainly to the long axis of the intestine. At certain points a more or less complete internal circular layer is present. See Brunner's Glands.



Simple tubular glands of large intestines of dog; the epithelial elements lining the follicles have become very largely converted into goblet cells.

Blood-Vessels, Lymphatics, and Nerves. The larger arterial trunks pierce the serous and muscular coats, in which they give off branches, and form a rich network in the submucosa. From this network smaller branches are given off, which form a capillary anastomosis throughout the mucous membrane extending up into the villi. From the capillaries arise veins which empty into the venous plexus of the submucosa, from which larger venous trunks pass outward, accompanying the arteries. The lymphatic system of the intestine is very extensive. Beginning as blind canals in the villi, the lymphatics pass downward to form a plexus in the deeper layers of the mucosa and in the submucosa. From this plexus larger lymphatic vessels pass outward to the mesenteric lymph-glands. The nerves of the intestine are mainly non-medullated fibres from the abdominal plexus of the sympathetic. Between the two muscular layers the nerve-fibres form a rich plexus, known as the plexus of Auerbach. From this plexus fibres extend to the submucosa, where a second plexus, called the plexus of Meissner, is formed. In both plexuses microscopic groups of ganglion-cells are found.

The Large Intestine. This differs from the small intestine in several important particulars. The mucous membrane is entirely devoid of villi and its glands, which are of the simple tubular variety, open upon the surface of the mucosa. In the cæcum and colon the internal muscular coat is thinner than in the small intestine, and the external longitudinal muscle, instead of completely surrounding the gut, as in the small intestine, is collected into three flat bands. As these bands are shorter than the other layers which make up the intestinal wall, they are responsible for the sacculation which is so characteristic of the large intestine. In the rectum the serous coat is replaced by a fibrous coat, and toward the anus the circular muscular coat becomes thickened and is composed of voluntary muscle forming the internal anal sphincter muscle. Solitary lymph-nodes occur throughout the large intestine. The collections of nodes known as Peyer's patches are, however, usually confined to the small intestine. The distribution of blood-vessels, lymphatics, and nerves is similar to that in the small intestine.

INTI, ĕn'tê. The deified sun, worshiped by the Incas of Peru.

INTIMIDATION (from ML. *intimidare*, to intimidate, from Lat. *in*, in + *timidus*, afraid, from *timere*, to fear). Literally, the act of making afraid, in law specifically said of the unlawful use by a person or combination of persons of threats of violence, or of force to compel another to do or refrain from doing an act which he has a legal right to do or abstain from doing, as he chooses. For this form of duress (q.v.) as exercised by combinations, as of strikers, manufacturers, merchants, etc., the term intimidation is especially used. No exact statement of what constitutes such intimidation unlawful has yet been given, nor probably can such a statement be made. Neither are the principles upon which the question in any case shall be decided well settled, although this question is one of primary importance in the administration of the law as affecting strikes of employees against their employers, and as affecting combinations among employers to coerce employees, as of manufacturers or dealers either to coerce others or drive them out of business. When the acts complained of as constituting intimidation are unlawful in themselves regardless of the question of intimidation, there is no difference of opinion in the cases in holding that such acts, when they reasonably result in coercing a person from the exercise of his legal freedom of conduct, constitute unlawful intimidation; as where actual physical violence is threatened and overt acts are done in pursuance of the threat.

Where, however, the acts complained of result in intimidation because of the number of persons by whom they are done in concert or in accordance with a common plan of so affecting the business or affairs of plaintiff, but would be harmless or ineffectual without such combination, the decisions are at variance. For example, the courts are not agreed as to what is and what is not legal picketing, as it is called; as to the legality of notice posted in the meeting-rooms of trades unions affecting the standing of particular employers; as to the legality of designating a shop as a scab shop; of the manner that may be used in requesting other workmen to quit work; of notifying employers that they have non-union men who must be discharged to prevent a strike; of the fining of members to compel them to strike, etc. Formerly the law (common law) was unjust in its discrimination against the performance of these acts by combinations of workmen or others; but these rules have been much modified both by statute and judicial decisions. Generally speaking, the courts of the United States, and of some States, as Massachusetts and New Jersey, adhere more closely to the spirit of the old common-law rule than is done in some of the other States, as New York and Illinois, where the effort of organized labor has been more effective in modifying it. The most general question that remains unsettled is as to whether it is lawful for a body of men to do in unison or in pursuit of a common purpose any act which it should be lawful for each member of the body to perform as an individual, or whether such acts so performed may under the given conditions amount to a conspiracy. See further under Conspiracy; Duress; Tort; Strikes and Lockouts; Boycotting; Picketing, etc., and consult the authorities under Tort. Consult also, for a statement of the latest development of the subject in Great Britain, the case of Allen *vs.* Flood, *House of Lords Cases;* and for the latest development of the subject in the State of New York, The National Protective Association *vs.* Cummings, *New York Court of Appeals Reports*, 1902; Beattie *vs.* Colleman, *New York Supreme Court Reports*, 1903.

INTINE, ĭn′tĭn *or* ĭn′tēn (from Lat. *intus*, within). The inner and more delicate layer of the spore wall. The outer and heavier one is called the 'exine.' The intine is also sometimes called the 'endospore.' See Spore.

INTONATION (from ML. *intonare*, to sing according to tones, from Lat. *in*, in + *tonus*, Gk. *τόνος*, *tonos*, tone; connected with Lat. *tendere*, Gk. *τείνειν*, *teinein*, Skt. *tan*, to stretch). In music the production of tone either by an instrument or by the voice. It is of no importance in keyed instruments like the piano or organ, as the performer can only strike the proper key and is powerless if the instrument is not in tune. But the matter of intonation is of utmost importance in the voice and all string and wind instruments. Only a person having a finely trained ear is able to produce proper intonation. Hence we speak of pure and false intonation.

INTOXICATING LIQUORS. All liquors which may reasonably be used as beverages and which contain enough alcohol to produce entire or partial intoxication if drunk in ordinary quantities.

An exact definition of this term is important under all excise and prohibition statutes, but as many palatable mixtures containing alcohol are sold in evasion of such laws, no definite enumeration of such liquors is possible. The statutes of many States are broad enough to cover all preparations or compounds containing alcohol when they come within the above definition.

The courts in most jurisdictions will take judicial notice of the character and effect of the well-known liquors, such as gin, whisky, brandy, etc., but will require proof of the intoxicating qualities of mixtures containing alcohol, such as cordials or the various tonics. An interesting discussion of this subject will be found in the "Intoxicating Liquor Cases," reported in 25 Kan. Rep. p. 751. See Excise; Prohibition.

INTOXICATION (ML. *intoxicatio*, from *intoxicare*, to poison, from Lat. *in*, in + *toxicum*, from Gk. *τοξικόν*, *toxikon*, poison, originally that poison in which arrows were dipped, from *τοξικός*, *toxikos*, relating to a bow, from *τόξον*, *toxon*, bow). In medicine, poisoning by any agent; colloquially, a condition of impaired will and undermined control resulting from drinking alcoholic beverages. Intoxication is as correctly used of serious disturbance of mental and physical equilibrium by the use of opium, chloral, belladonna, cannabis indica, or by the ingestion of lead, as of the poisoning resulting from the use of liquor. Alcoholic intoxication may be acute, subacute, or chronic. Acute intoxication follows drinking a considerable quantity of liquor at once. Profound insensibility follows speedily, with stertorous breathing, purplish face, frothing at the mouth, weak pulse, and increasing coma. An active purge, such as croton oil, put on the root of the tongue or introduced into the rectum, together with hypodermic injections of strychnine, both used after the employment of the stomach-pump, may be efficacious and save life. This form of intoxication is rarely seen. The subacute form is the usual drunkenness, of mild or serious type. It is the form observed in those who drink alcoholic beverages for the exhilaration they feel, or in those who drink till they are stupefied. Slight intoxication causes increased activity of the circulation and of nervous and mental processes, as well as in most cases derangement of the digestive apparatus. Heavy drinking results in delirium, staggering (due to cerebellar disturbance), loss of muscular power, and finally stupor. Vomiting, depression, and tremor appear when the person awakes or becomes conscious. An emetic, a cathartic, and a Turkish bath often rouse an intoxicated person when becoming drowsy, and prevent the occurrence of the coma which threatens. But after repeated indulgences these measures fail. Ammonia and strychnine are both very serviceable in treating the conditions existing after the patient is aroused from his unconsciousness. Habitual intoxication results in *delirium tremens* in some cases. (See Delirium.) In others, it leads to alcoholic insanity. (See Insanity.) Serious organic diseases result from the use of alcohol, such as cirrhosis of the liver, cirrhosis of the kidneys with secondary heart disease, and arteriosclerosis, all of which are discussed under their proper titles. The will becomes undermined, judgment becomes impaired, and the idea of moral responsibility becomes diminished or lost.

Inebriety. This is the diseased mental condition resulting from the use of alcohol. There may have been an underlying neurasthenia, which has led the patient to seek some agent which will remove his weakness and lack of endurance. Repeated recourse to alcoholic stimulation frequently results in inebriety in such a case. Heredity plays a prominent rôle in the causation of inebriety. Inebriety or insanity is found in the ancestry of about half the cases. Race has a certain influence. Denmark and Belgium suffer from the greatest amount of inebriety in the Continental countries; Russia and Germany come next, and France, Sweden, Austria, and Switzerland follow. The Anglo-Saxon seems very susceptible to the disease. The Italian is singularly free from it, and the Spaniard has nearly as good a record. The Jewish people present an example of general freedom from inebriety wherever they are found. A hot, moist climate favors inebriety by reducing general nervous resistance. Exposure and occupation have also an evident influence. The mortality from alcoholism is stated by Norman Kerr to be 40,000 annually in Great Britain. He quotes Lankester as saying that one-tenth of the entire mortality in Great Britain is due to alcoholism.

Medico-Legal Aspect. The tendency to commit crime is much greater in inebriates than in others, because of the weakening of the will and the lessened moral sense. It is held that intoxication is no excuse for commission of crime, and the criminal who remembers nothing of his acts committed while under alcoholic influence must pay the penalty due to his offenses. Consult Kerr, *Inebriety* (Philadelphia, 1888). See Alcohol, Physiological and Poisonous Action of; Alcoholism; Dipsomania.

INTRA. A manufacturing town in Italy, on Lago Maggiore (q.v.).

INTRANSIGEANTS, ăɴ'träɴ'sē'zhäɴ' (Sp. *intransigente*, uncompromising, from Lat. *in-*, not + *transigere*, to make a settlement, from *trans*, across + *agere*, to act). A term applied in European politics during the last half-century to any ultra-radical element. In Spain the name was given to a party of Red Republicans and Socialists who, after the declaration of the Republic in 1873, attempted to divide up the country into cantons, and to introduce a communistic régime. They held Carthagena for six months against the Government, but were put down by the dictator Castelar and General Dominguez. The term had been used in France before this at the time of the Commune. *L'Intransigeant* is a newspaper published in Paris by Henri Rochefort (q.v.), the famous radical politician.

INTRENCHED CAMPS. See Fortification.

INTRENCHMENT (from *intrench*, from *in-* + *trench*, from OF. *trencher*, *trancher*, Fr. *trancher*, to cut, from Lat. *truncare*, to lop, from *truncus*, trunk, from *truncus*, OLat. *troncus*, maimed). Any form of constructive defense work by which soldiers strengthen a position, or fortify it against an enemy. See Fortification; Trench, Military.

INTRODUCED SPECIES. Animals and plants brought into a country from a foreign land by the agency of man. In the settlement of North America from the Old World scores of species of plants, mostly noxious weeds, and hundreds of species of animals, largely parasitic or destructive to agriculture, have been introduced. Among plants, chicory, wild garlic, and the water hyacinth of Florida are examples of the great spread of introduced species. Domesticated animals may escape from captivity and become noxious. The wild pigs of our Southern States and the Galapagos Islands are examples. Goats have become wild in many places, and have wrought great destruction. Thus the island of Saint Helena, which is now a barren rocky desert, was formerly clad with forests. The change has been brought about in four centuries by goats. Cats that have become wild on islands have in many cases exterminated species of birds there. Rats and mice, in some cases previously imported from Asia, have been introduced into this country from Europe, and have spread everywhere, exterminating native species and conquering one another.

The European rabbit was introduced into Australia in 1864 for sporting purposes. By 1879, legislatures were enacting laws for its destruction; and recently an important industry has arisen in rabbit-skins and canned rabbit-meat. The setting free of Belgian hares in this country is attended with dangers. (See Rabbit.) The mungoos of India was introduced into Jamaica in 1872 to rid the island of rats, whose depredations caused an annual loss of $500,000. In 1882 the mungoos had caused such a diminution in the rats that the annual loss from rats was reckoned at about one-half the former amount; but the mungoos multiplied, domestic animals and barnyard fowls were destroyed by it in vast numbers; next native vertebrates fell a prey, also bananas and other fruits. About 1890 the mungoos became recognized as the worst pest of the island, and as doing vastly more harm than good. Of late years, however, the depredations of the animal have begun to diminish. (See Mungoos.) Other examples of imported animals which have wrought untold damage might be cited at great length. The English sparrow, the cabbage butterfly, the Hessian fly, the gypsy moth (in Massachusetts) are familiar examples elsewhere described in detail. The reason why introduced animals thrive to so extraordinary degree is because they are removed from their natural enemies, and those that might keep them down have not learned to do so. Usually, in time, enemies are acquired, as they have been by the English sparrow, and thus the balance in nature is restored. Consult: Palmer, "The Danger of Introducing Noxious Animals and Birds," in *Year Book of Department of Agriculture* (Washington, 1898). See Acclimatization; Isolation.

INTRODUCTION (Lat. *introductio*, a leading in, from *introducere*, to lead in, from *intro*, within + *ducere*, to lead). In instrumental music, a shorter movement preceding the composition proper. According to the character and length of the composition the introduction may be shorter or longer. In a polonaise, waltz, etc., the introduction generally consists of only a few bars. In works written in sonata form the introduction can assume great dimensions, as in Beethoven's *Second* and *Seventh Symphonies*. The thematic material upon which the introduction is built may be entirely original and independent of any themes in the following principal movement, as in the case of the two Beethoven symphonies. Then again the introduction may be constructed upon themes of the movement proper, as in the case of Schumann's *First Symphony*. As the introduction is invariably in a slow tempo, the themes of the allegro appear almost invariably in augmentation when used in the introduction. But it is by no means obligatory to begin every longer composition with an introduction. Of Beethoven's symphonies the third, fifth, sixth, eighth, and ninth begin without any introduction.

In dramatic music the term introduction has several meanings. In the older operas, which were divided into *numbers*, the introduction was the second number. It followed the overture, and generally was a short instrumental passage leading into the opening chorus. But even Gluck sometimes united the overture with the introduction. Some operas have no overture, but only an introduction of greater or less extent. Such works as Verdi's *Otello* or *Falstaff* have, properly speaking, not even an introduction. Beginning with *Lohengrin*, Wagner abandoned the form of the overture and substituted an introduction which he calls Vorspiel (q.v.). Besides the principal introduction at the beginning of his dramatic works, Wagner generally opens every act with an introduction of some length.

INTRO'IT (Lat. *introitus*, entrance). An antiphon sung or said at the beginning of the mass, varying with the season or festival. After the antiphon proper comes a verse from the Psalms, followed (except in requiem masses and in Passion-tide) by the *Gloria Patri*, and the repetition of the antiphon. The opening words of the introit are commonly used in ecclesiastical terminology to designate the proper mass of the day; and certain Sundays are even popularly known in the same way, as *Gaudete*, *Lætare*, *Quasimodo* Sunday, etc. This practice is very usual in mediæval documents and authors.

INTROMISSION (ML. *intromissio*, from Lat. *intromittere*, to send within, from *intro*, within + *mittere*, to send). In Scotch law, the assumption of legal authority to deal with another's property. It is divided into legal and vicious intromission. Legal intromission is where the party is expressly or impliedly authorized, either by judgment or deed, to assume the management and control of an estate. Vicious intromission is where a person without legal authority interferes with a deceased person's estate, as by assuming to act as heir or as executor of a will. Such acts constitute a usurpation, but have a certain qualified validity, and cannot be impeached collaterally. They correspond to the acts of an executor *de son tort* of English and American law. See EXECUTOR.

INTROSPECTION (from Lat. *introspicere*, to look within, from *intro*, within + *spicere*, *specere*, to look; connected with Gk. *σκέπτεσθαι*, *skeptesthai*, Skt. *spaś*, *paś*, to look, OHG. *spehōn*, Ger. *spähen*, to spy). The specific method of psychology, as observation or inspection is the specific method of physical science; also termed SELF-OBSERVATION or 'INNER RECEPTION.' The three names are characteristic of three different attitudes toward the study of mental phenomena, which we may term the rationalistic, the empirical, and the experimental. (1) Kant declared that a science of mind is impossible, for the reason, among others, that the method of psychology is impracticable: self-observation implies a change of the very facts which we desire to observe. If self-observation were, literally, the method of psychology, Kant's objection would be valid. If, then, psychology were forced to rely on self-observation, there could be no ascertainment of mental uniformities, no science of mind; the more attentive the observer, and the more systematic his use of the method, the scantier would be his harvest of facts; speculation would have free play. Hence the empirical school (2) substituted for self-observation the method—or, rather, the unmethodical employment—of inner perception (*innere Wahrnehmung*). Observation is planned and prepared for; perception, the noting of events and conditions as they appear, is a matter of happy accident. Now inner states and processes can be perceived or noted as well as outer; there is no self-contradiction involved in the phrase 'inner perception;' but, at the same time, the loss of the plan and system implied by the term 'observation' is a serious handicap to a science, and must lead to inadequacy both of description and of theory. We find, accordingly, that the introspection or inner perception of the empirical psychologists has no claim to rank as a true scientific method. It makes the cardinal mistake of considering merely the most obvious aspect of mind—its cognitive function; it views mental processes always through the glass of meaning, of logical import; it tells us what mental events stand for, but not what they are. It is clear that we should gain little knowledge of the anatomy of our bodies by a superficial cataloguing of the bodily functions, as they are apparent in the occurrences of every-day life; indeed, that we might go sadly astray, in our attempt to translate function into the unknown language of structure. The same thing holds of mind, as interpreted by the method of inner perception. (*a*) In the first place, the method leads to an overemphasis of what James has called the 'substantive' factors in the stream of thought, and to an underemphasis of the 'transitive' parts. We read of images and ideas and representations; but the 'fringes' of these psychical entities, the elusive and yet essential processes which Spencer (still in logical terms) has denominated 'feelings of relation,' are left entirely out of account. The result of this error is that mind is pictured as if composed of discrete and sharply separable terms (the 'sensations' or 'ideas' which correspond to the simplest 'bits of knowledge'), instead of being presented as what it really is, a shifting continuum, a tangle of ever-moving and ever-changing processes. (*b*) A second mistake to which inner perception is liable is that which has been called *par excellence* the 'psychologist's fallacy.' The psychologist is tempted to read himself, his own knowledge and attitude, into the mental process or group of mental processes which he is considering. Instead of taking the mental stuff as it is, in the incompleteness and abstractness which are conditioned upon its detachment from context, he rounds it off and supplements it by his outside knowledge of this context. He is thus tempted into a twofold error. On the one hand—misled by the poverty of language, which ordinarily names a perception or idea by naming the object to which it refers, no matter what the mode or character of this reference may be—he is easily brought "to suppose that the thought, which is *of* the object, knows it in the same way in which he knows it, although this is often very far from being the case." On the other hand, since he is himself familiar with all the relations in which the given mental process stands, he is apt to read an awareness of these relations into the process; he makes the process conscious of itself as he is conscious of it. The result is that we are furnished not with a description, but with a logical construction of mind; while, as there is no appeal from the logical construction to the facts, empirical psychology is full of quasi-logical controversies, that are not only long drawn out, but are in the nature of things incapable of psychological termination.

(3) We arrive at introspection proper only when we reach the point at which the experimental method is introduced into psychology. (See PSYCHOLOGY, EXPERIMENTAL.) This does not mean that there was no valid introspection before there was experiment; men are often better than their methods. Nor does it mean that all the results of experimental research are the fruits of an unimpeachable introspection; methods may be better than the men who use

them. It means that, with the advent of experimental control, psychology was able to combine the attitude of inner perception with the plan and system of self-observation; and that this science thus acquired a method which is as accurate and reliable in principle as are the methods of the physical sciences. Experiment enables us so to regulate external conditions that a determinate mental occurrence may be induced at a determinate moment of time; it enables us, further, to prevent any modification of consciousness save by the occurrence under investigation. Given a state of concentrated attention (q.v.) on the part of the observer, the requisite degree of practice, a retentive memory (q.v.), and an adequate command of language wherewith to report the experience (see DISCRIMINATION, SENSIBLE)—and there is no reason why a psychological introspection may not be as exact as an observation in chemistry or physics.

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INTRUSION (ML. *intrusio*, from Lat. *intrudere*, to thrust in, from *in*, in + *trudere*, to thrust; connected with OChurch Slav. *truzdati*, to torment, and probably with Goth. *þriartan*, AS. *þrēotan*, OHG. *-driozan*, Ger. *-driessen*, to vex). In English law, an unlawful entry upon a freehold estate, not at the time in the actual seisin of the rightful owner, and with the view of ousting him of his estate. It could be effected in the interval between the death of a tenant in fee and the actual entry of the heir, or between the death of a tenant for life and the entry of the remainderman. Though not technically classed as a disseisin (q.v.), it had similar effects, vesting the seisin and title in the intruder. The usual remedy for an intrusion was by a writ of entry. The distinction between the several kinds of ouster (q.v.), dependent upon the time or manner in which it was effected, has generally been abolished in England and the United States, and the whole subject comprehended under the description of adverse possession and disseisin. In Scotch law the term is employed in a looser sense to describe a trespass upon lands.

INTUITION. See INSTINCT.

INTUITIONISM, or **INTUITIONALISM** (from *intuition*, from ML. *intuitio*, immediate cognition, from Lat. *intueri*, to look at, from *in*, in + *tueri*, to look). The name of the theory that our knowledge of at least some fundamental principles, whether of metaphysics or of ethics, is due to the fact that they present themselves to us as true in their own right, and therefore need no proof of any sort. The view supposes that we have certain faculties for the immediate apprehension of these principles; thus our intellect is supposed immediately to apprehend the truth that two and two are four, and our conscience the truth that theft is wrong, or that action prompted by benevolence is better than action prompted by sensual appetites. In ethics, intuitionism is also used to designate the view that not general principles are immediately apprehended, but the rightness or wrongness of each particular act. These views fail to recognize the fact that an unreasoned assurance of a truth may be the psychological outcome of forgotten processes of reasoning. For an account of the origin of our knowledge of general truths, see INDUCTION; KNOWLEDGE, THEORY OF.

INTUSSUSCEPTION (from Lat. *intus*, within + *susceptio*, a taking up, from *suscipere*, to take up, from *sub*, under + *capere*, to take), or INVAGINATION OF THE INTESTINES. A displacement of a portion of the intestine into the part immediately below, just as the finger of a glove may be partly drawn within itself when the hand is withdrawn. This is a common form of intestinal obstruction occurring most frequently in infants and young children. The exciting *cause* is usually some irritant bringing about irregular and exaggerated intestinal peristalsis. Injudicious diet, the careless use of cathartics, and the presence of intestinal polyps are the common causative factors. The *pathological conditions* present are: the invagination mentioned above, and more or less inflammation in the affected part of the intestine. The commonest site of the lesion is at the junction of the small and the large intestines. The involved portion of the intestine may measure anywhere from a few inches to as many feet. Unless promptly treated death usually results in a short time from gangrene of the intestine, perforation, and general peritonitis. In adults the invaginated portion of the intestine may become gangrenous, separated, and passed per rectum. Such a termination is frequently followed by the formation of a contracting scar, resulting in a chronic form of obstruction. The symptoms are: Violent abdominal pain, rather sudden in its onset; vomiting of stomach contents and of biliary and fæcal matter; abdominal distention; the passage of bloody mucous per rectum; collapse; normal or subnormal temperature. Palpation reveals the presence of a tumor; by rectal examination the invaginated gut may be felt with the finger, or it may even protrude through the anal orifice. The *treatment* is purely surgical, and should be prompt. A laparotomy is performed and the intestinal displacement corrected. The prognosis is not at all bad in cases operated on early. In neglected cases the disease is almost invariably fatal.

INULIN. A starch-like constituent of some plants. See ELECAMPANE.

INUNDATION (Lat. *inundatio*, from *inundare*, to overflow, from *in*, in + *undare*, to rise in waves, from *unda*, wave; connected with OHG. *undea*, *unda*, AS. yþ, wave). Many large areas of low ground near rivers or the ocean are in danger of inundation from various causes. Of these inundations the most common, and probably also the most destructive, are the river floods that result from unusual rains or melting snows. Most rivers are subjected to rising and falling by these causes, and those that flow through flood plains or deltas may rise and overflow the bordering plains. The best-known instance of such river flooding is supplied by the Nile, which makes possible the existence of millions of people on the Nile oasis in the broad African desert. The rising of the waters begins in June in the lower Nile, the accumulation having taken weeks to flow down the river channel from the upper waters. It continues till September, and at Cairo the water reaches a height of 25 feet above the normal river level. A vast tract of flood plain and delta is inundated, and this water makes agriculture possible in the desert, and is the basis upon which the ancient Egyptian agriculture was founded. The sediment deposited by the floods fertilizes the land, and is raising the level of the flood plain at a rate of over four inches a century. The Mississippi also supplies an illustration of great river floods. An area of 30,000 square miles, inhabited by a million people, is liable to floods. Low natural embankments, built by the floods, and called natural levees, keep the river in its channel, excepting during very high water; and levees added by man are built from the Gulf to Cairo in the effort to hold the extraordinary floods. But even these artificial levees are sometimes ineffective. Crevasses 50 to 500 feet wide break through the levees and a vast area is inundated. These great floods come usually between February and May, and are caused by the coincidence of heavy rains, or rapidly melting snows, or both, in the Missouri, Mississippi, and Ohio valleys. During the great floods the discharge of the Mississippi reaches 2,000,000 cubic feet per second, and is far in excess of the capacity of the channel. The water-level then rises 40 or 50 feet, and great destruction of life and property results. Great inundations by the Mississippi are recorded in 1828, 1844, 1849, 1850, 1853, 1859, 1863, 1867, 1870, 1874, 1882, 1884, 1890, 1892, 1893, and 1897. The Hoang-ho of China flows out of its mountainous course over a low alluvial fan delta which is rapidly growing out into the sea. The town of Putai, which was on the seacoast about 2000 years ago, is now over 40 miles inland. Not only is the alluvial fan delta growing outward, but upward, and when the river bed is built up above the level of the surrounding plain the course of the stream becomes exceedingly unstable and liable to shifting in time of flood. The river then sometimes bursts through levees fully 70 feet high, erected more than half a mile from the banks. It has shifted its course nine times in 2500 years, laying waste a region as large as Great Britain. Its mouth has changed position fully 200 miles by these shiftings. In the flood of 1887, which covered an area of 50,000 square miles, densely populated, a million people were drowned, and still more lives were lost by the famine and disease that followed the disaster. The river has been used as a weapon of war as far back as the year 1209. Hundreds of thousands of people have thus been drowned by the turning of the river floods against them. Smaller river floods are of common occurrence, and are frequently caused by ice jams, which form a temporary dam and hold the water back. The bursting of the dams of artificial ponds and lakes also causes destructive floods.

Inundations of the sea are far less widespread than those of rivers, because some coasts are too high, and others are not frequently visited by high sea or 'tidal waves.' The great number of river lowlands, and the frequency of the causes of a rise in the river water, makes these river floods more general than those of the sea. But where low coasts are exposed to inundations of the sea, the results are terribly destructive, especially since the lowland coasts are usually densely populated. There are various causes of inundations by the sea; the simplest are illustrated by those countries which are actually below the level of the highest tides, and are protected from inundation by sand-dune hills and dikes. The Netherlands offer the best illustration. This plain is the delta of the Rhine and Meuse, and is open to floods from river and ocean, and parts of it lie well below the level of the sea. At various times the dikes, which were formerly less solidly constructed than at present, have given way, and large tracts have been submerged, causing a vast destruction of life and property. For example, in 1421 a flood destroyed 72 villages, and 100,000 people perished. During the Spanish wars the people voluntarily admitted the sea to protect their cities from the attacks of the Spaniards.

Even dry land several feet above sea-level is subject to inundations by the sea when there is some unusual rise in the water, commonly called a 'tidal wave,' doubtless because it reaches its greatest height at high tide. The lowlands of the Netherlands, Denmark, and England have suffered from such floods when high winds have driven water upon the shore and piled it up at periods of unusually high tide. At such times the surface of the sea may rise 10 or 15 feet higher than the normal reach of the high tide. The West Indies, the Gulf Coast, and the coast of the Middle Atlantic States are subject to such inundations during the passage of the fierce tropical hurricanes. The flooding is experienced even as far north as New York and Boston; and the destruction at Galveston, September 8, 1900, when thousands of lives were lost, was due to the passage of one of these hurricanes. The Sea Islands on the Georgia coast are occasionally flooded during these storms, and any low point along the coast south of New York is liable to such 'tidal waves' at any time, but especially in August and the autumn months, when tropical hurricanes develop most commonly. High water followed the hurricane of September 3-12, 1889, all the way from the West Indies to New Jersey. The rise in the level of the ocean during the passage of these storms is due to the combination of ordinary tides with the effect of the steady violent winds which drift the water before them and pile it up on the shelving shore. As illustrated in Galveston, this wave rises over ordinarily habitable land, undermining houses, and thus aiding in the destruction done by the winds themselves and the wind waves which these winds raise on the surface of the sea. Far greater destruction of life is accomplished in the Pacific than in the Atlantic by these tropical storms, there called typhoons. The sea wave washes over low coral atolls. In the case of the Samoan hurricane of March 15, 1889, a typhoon washed ashore 21 vessels that were anchored in the harbor of Apia. Some 150 of the sailors on these vessels were drowned, and only two of the ships that were in the harbor were afloat after the hurricane. Typhoon waves advance on the low delta coasts of India and Southern China. There has been case after case of destruction of life to the number of many thousands in the delta lowlands of Asia; and in at least one case, in 1876, it is estimated that 150,000 people were killed by such an inundation in the delta of the Ganges and Brahmaputra.

Finally, sea waves generated by earthquake shocks may inundate coastal lands. These, again, are best illustrated on the low, densely populated coasts of Asia, where earthquake shocks are numerous. The earthquake wave, caused by a jar along the seashore or on the sea bottom, disturbs the entire sea from surface to bottom. The wave is dome-shaped, though not very high, perhaps not over an inch or two. But it is so deep and broad that, advancing over the shallowing bottom toward the shore, it grows higher and higher, perhaps reaching a height of 100 feet. The wave rushes over the land with terrible force and destructiveness. The earthquake which destroyed Lisbon in 1755 was accompanied by a prodigious tidal wave. By the earthquake wave caused in 1883 during the eruption of Krakatoa in the Strait of Sunda, a water wave was generated which rose from 50 to 80 feet, upon the neighboring lowlands, drowning thousands of people, and carrying a large vessel inland a distance of a mile and a half, leaving it stranded 30 feet above sea-level. By an earthquake wave, June 15, 1896, a part of the coast of Japan was devastated for a distance of 175 miles, 27,000 lives were lost, and 60,000 people made homeless. Many similar instances are on record.

Bibliography. Vallès, *Etudes sur les inondations, leurs causes et leurs effets* (Paris, 1857); *United States Engineer's Report* (Washington, 1875); *Mississippi River Commission Reports* (Washington, 1882-92); *Montreal Flood Commission Report* (Montreal, 1890); Von Sonklar, *Von den Ueberschwemmungen* (Leipzig, 1883); *Work of the Weather Bureau in Connection with the Rivers of the United States* (Washington, 1896); Stoney, *Extraordinary Floods in Southern India* (London, 1898); Williams, *On Some Effects of Land Floods in a Tidal River* (London, 1891); "Storm Waves on the Great Lakes and the Ocean," *Monthly Weather Review* (Washington, 1895).

INVALIDES, äɴ'vȧ'lēd', Les (Fr., invalids). Wounded veterans of the French Army, maintained at the expense of the State. The Hôtel des Invalides is an establishment in Paris where a number of these old soldiers are quartered. The institution was founded by Louis XIV. in 1670. In 1811 it was reorganized; in 1832 its property was alienated and the institution made a charge upon the annual budget. The hôtel can accommodate 6000 men, but the actual number of inmates is now much smaller. The dome of the *Invalides*, in the crypt of which is the tomb of Napoleon I., is one of the most imposing structures in Paris.

INVALIDING (from *invalid*, Fr. *invalide*, invalid, from Lat. *invalidus*, not strong, from *in-*, not + *validus*, strong, from *valere*, to be strong). In military phraseology, a soldier is said to be invalided when he is sent home from abroad, as a result of climate, wounds, or other causes rendering him unfit for duty. In the United States he would be sent to a general hospital (see Hospital), where it would be decided whether he remained in the army or be returned to civil life. English soldiers are sent to Netley Hospital for similar treatment and final disposition.

INVARIABLE PLANE. In the solar system, a plane about which the planets' orbits perpetually oscillate, deviating from it only to a very small extent on either side. This plane passes through the centre of gravity of the solar system, and is so situated that if all the planets be projected on it, and if the mass of each planet be multiplied into the area which is described by the planets' projected radius vector in any assumed unit of time, the sum of such products will be a maximum. By means of this property, independent of any particular epoch, it will be easy for astronomers in future time to determine the exact position of the plane, and to compare observations together by means of it. Such a plane is not peculiar to the solar system, but must exist in all systems where the bodies are acted on by no other force than their mutual attraction.

INVARIANT. See Forms.

INVASION (Lat. *invasio*, attack, from *invadere*, to invade, from *in*, in + *vadere*, to go, connected with OHG. *watan*, Ger. *waten*, AS. *wadan*, Eng. *wade*). The act of entry into an enemy's territory during time of war. In ancient and mediæval times, when an army invaded a country, pillage, devastation, and slaughter were the rule. It was not until the War of the Spanish Succession that Marlborough and Villars, by a system of contribution, introduced comparative humanity into the conduct of armies. The Prussians and Austrians during the wars of Frederick the Great were generally dependent upon regularly levied supplies. During the Revolutionary War, the British Government declared it to be a right of war: (1) to demand provisions and raise contributions, enforceable, if necessary, by the sword; (2) to ravage territory where there was no other way to bring an enemy to engagement or terms; (3) to treat all rebels as enemies. The right to ravage has not been asserted or acted upon since by either country, except in the case of the burning of the Capitol and other buildings at Washington by the British in 1814, which was a gross and unjustified violation of the rules of war. Napoleon enforced the principle that war must pay for war; and after the battle of Jena, the exaction required of Prussia was more than a hundred million francs, while a like contribution was levied upon Spain in the course of the Peninsular War.

The rights of an invader toward the country overrun by him are large and important, but these rights of belligerent occupation held as confined to the districts actually dominated by the invading force must be carefully distinguished from those of conquest. The invaders' military rule in general supersedes the civil authority. In relation to property, a sharp distinction must be drawn between public and private property. As to the former also the invader's rights are held to differ with its character. Thus the contents of the Palatine libraries were carried off to Rome during the Thirty Years' War, and Napoleon filled the Louvre Galleries from every capital of Europe; but the rule is now well established that public money, military stores, and public buildings are lawful sources of plunder; public estates may be occupied, and the rents and profits therefrom appropriated; telegraph and railway property pressed into service, and public edifices interfering with military operations destroyed; but property not contributing to the uses of war must remain intact. The removal by the Germans of the astronomical instruments from the Observatory of Peking during the recent expedition of the Allies against the Chinese capital was a violation of this rule.

The attitude of an invader toward private persons and property has been clearly defined; but, though pillage is strictly forbidden, this restriction does not insure absolute security for an enemy's property. Private persons taking no part in the conflict are to remain unmolested, but inhabitants of an invaded district aiding their country forfeit protection, and are subject to military execution, though the interests of humanity are conserved by this distinction between soldier and non-combatant. Property movable and immovable is to remain uninjured. If needed by the hostile army, the invading general may require its sale at prices fixed by himself, or even on occasions require their contribution without payment; but marauding must be checked by discipline and penalties. Such forced contributions of food, forage, labor, wagons, railroad rolling-stock, or other means of transportation are called requisitions. See Contribution; Conquest; and also International Law and the authorities there referred to.

INVEC'TA ET ILLA'TA (Lat. nom. pl., carried in and borne in). An expression of the civil law, found also in the law of Scotland, to denote all things which a tenant has brought upon the premises, as his household furniture, tools, utensils, etc., and which are subject to the lien, or tacit mortgage, of the landlord for the rent of the premises. The English and American legal system in general recognizes no such lien, the landlord's remedies being confined to distress (q.v.) and to an action at law for the rent due.

INVECTED (from Lat. *invectus*, p.p. of *invehere*, to carry in, from *in*, in + *vehere*, to carry). A partition line in heraldry (q.v.).

INVENTION (Lat. *inventio*, finding out, from *invenire*, to find, from *in*, in + *venire*, to come). Literally, an act of making something not before made; also, the new thing produced. In the law of patent rights the term invention is specifically applied to any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement thereof, which when invented may under certain conditions be made the subject of the rights of a letter patent. In Great Britain the patent law expressly restricts such inventions to a 'new manufacture,' but the courts have construed this term so that it includes the four classes of inventions above named. Although it has been held that in the patent law 'discovery' and 'invention' are synonymous, in popular language and in much legal literature the term 'invention' has come to be used commonly to designate a 'patentable' invention, or one that is 'new' and useful.

To constitute an invention in this sense there must be a creating or origination of some useful thing that did not exist before, by means of an operation of the intellect. The extent of research and the simplicity or complexity of the result are of no importance, if the invention be new and useful, and be something more than a construction following the beaten track of mechanical experience. Neither is any distinction made as to degree of usefulness or the amount of mechanical skill involved in the construction or making of the invention, so long as the usefulness or skill be not so slight as to make it negligible. It is no objection that the inventor was aided or assisted by ideas derived from others, as long as the final concrete product invented be something more and distinct from any one or all of these ideas or suggestions. The difficulty in drawing the line as to what is and what is not an invention is great. Mere simplicity is no objection, and, indeed, may constitute the real excellence and newness of the invention. Neither is the use or application of old devices or machines an objection, for most patents are issued upon inventions based partly upon preëxisting inventions. A mere advance or extended application of an original invention, changed only in degree, and doing substantially the same thing in the same way by the same means, but with better results, is not an invention. There must be a new idea grafted upon the old invention. By reason of the difficulty here referred to, the law is liberally applied to protect everything that might be properly called new and useful. See Patent; and consult the authorities there referred to.

The title was also given by J. S. Bach to a collection of 30 short pieces in contrapuntal style, each developing only one theme. There are 15 two-part and 15 three-part inventions.

INVENTION OF THE CROSS. See Cross, Invention of the.

INVENTORY (from Lat. *inventarium*, list, from Lat. *invenire*, to find, from *in*, in + *venire*, to come; connected with Gk. *βαίνειν*, *bainein*, Skt. *gam*, to go, and ultimately with Eng. *come*). A written instrument setting forth in the form of a systematic schedule all the goods, chattels, and other personal property of a person or estate, whether for use in a legal proceeding or for ordinary commercial purposes. The term and the legal practice connected with its use originated in the reform of the Roman law instituted by Justinian to relieve the heir of a deceased person from his personal liability. In order to relieve the heir, and at the same time to protect creditors and legatees, a law was enacted under which the heir was relieved of all liability for the debts and legacies of his ancestor, excepting in so far as the property inherited by him would enable him to discharge the same, provided that within a certain time he should duly prepare and file a written instrument containing a correct enumeration of all property, real and personal, left by the deceased. If there was a surplus the heir was required to distribute it. See Heir.

Until about two centuries after the Norman Conquest, the identification of heir and ancestor was as complete under the English law as it had been under the Roman law before the above-mentioned reforms of Justinian. About that time, partially through the influence of the Roman law, the heir's liability was limited to the amount of property descending to him; executors or administrators superseded him for the purpose of administration of his ancestor's estate, and the Roman practice of making an inventory of the assets of the estate was introduced. This plan was probably adopted more for the practical advantage of compelling the personal representatives of the deceased to commit themselves at the outset as to the amount and character of property coming into their hands, than as a means of relieving the heir from liability, as that reform had apparently already been accomplished. The ecclesiastical courts assumed jurisdiction of estates, and inventories of the personal property were required to be filed in these courts, where they were open to the inspection of all persons interested therein. This practice is substantially followed to-day. The inventory usually contains a list of all the personal property of the decedent, with the appraised value set opposite each item, as well as a schedule of his debts and liabilities, the executor or administrator certifying by oath or affirmation that the whole is true to the best of his knowledge and belief, and attached is a sworn statement of the appraisers to the effect that they have faithfully and carefully performed their duties. It is filed in the court having jurisdiction of decedents' estates, and may be examined by the heirs, next of kin, legatees, and creditors of the deceased, who may object to it if anything is omitted or improperly entered. After the inventory is filed, the executor or administrator becomes accountable for the disposition or distribution of every item set forth therein, and it is therefore a most efficient means of insuring the honest administration of estates.

The term inventory is also properly employed to designate the lists of assets prepared by the trustees of bankrupts' or insolvents' estates, and by guardians of infants or other legally incompetent persons, for the information of the court having jurisdiction over them, and for convenience in the discharge of their fiduciary duties. The same publicity as in case of decedents' estates is obtained by filing and opportunity for examination. See ESTATE; EXECUTOR.

IN'VERA'RAY. A small fishing-port, the county town of Argyllshire, Scotland, on Loch Fyne, 45 miles northwest of Glasgow (Map: Scotland, C 3). An obelisk commemorates the death of seventeen Campbells, who were executed here without trial, in 1685, for their adherence to Presbyterianism. Inveraray Castle, the seat of the dukes of Argyll, heads of the Campbell clan, is close to the town. Population, in 1901, 735.

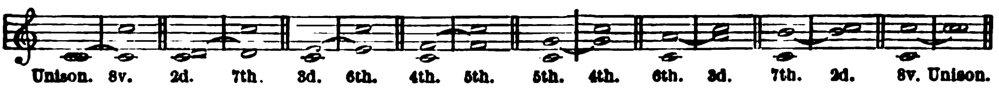
IN'VERCAR'GILL. A town in the Province of Otago, New Zealand, and the capital of the County of Southland, situated at the mouth of the New River, 139 miles by rail, southwest of Dunedin (Map: New Zealand, B 7). The harbor has a good anchorage for vessels under 1000 tons, and an important export trade is carried on in wool, mutton, timber, and grain. Its industries include numerous sawmills, flour-mills, and meat-refrigerating establishments. The town is well built on a rectangular plan; has Government buildings and a hospital. It is lighted by gas and has street railways. Population, in 1891, including suburbs, 8550; in 1901, 9950.

INVERLOCHY, ĭn'vẽr-lŏκ'ē. A castle in Inverness-shire, near which, on February 2, 1645, the army of Archibald Campbell, Marquis of Argyll, was utterly routed by the Marquis of Montrose (q.v.). The castle is now in ruins. Consult Gardiner, *History of the Great Civil War*, vol. ii. (London, 1886-91). See GRAHAM, JAMES.

IN'VERNESS'. A royal, Parliamentary, and municipal burgh and seaport, the county town of Inverness-shire, Scotland, on the Ness, near its embouchure, in the Moray Firth, at the northeast end of the Caledonian Canal (Map: Scotland, D 2). The town, picturesquely surrounded by wooded hills, has handsome wide streets and many beautiful residences. Its principal buildings are the cathedral, the county hall, infirmary, lunatic asylum, and Royal Academy; other features are the fountain, containing the famous blach-na-cudain, long regarded as the town palladium; the suspension bridge, and the Islands promenade. There are iron-foundries, ship-building yards, woolen manufactures, distilleries, breweries, and thread-making and bleaching works. The harbor, docks, and roads afford good accommodations, and a considerable domestic trade is carried on. The town owns its own gas-works. Inverness is of great antiquity, having been one of the Pictish capitals. William the Lion gave it four charters and made it a royal burgh. In 1411 it was burned by Donald of the Isles. The old castle, where Macbeth murdered Duncan, was razed by Malcolm Canmore, who replaced it by another which was destroyed by Prince Charles Stuart in 1746. The remains exist at the north of the town of the citadel which was built by Cromwell in 1652, and which was demolished at the Restoration. Population, in 1891, 19,200, of whom 4000 spoke Gaelic; in 1901, 21,193. Consult: Mackintosh, *Invernessiana* (Inverness, 1875); Anderson, *Inverness Before Railways* (Inverness, 1885); Grant, *The Commissariat Record of Inverness* (Edinburgh, 1897).

INVERNESS-SHIRE. The largest county of Scotland, in the northwest division (Map: Scotland, D 2). It includes several of the western islands, viz.: Skye, Harris, North and South Uist, and Barra, etc., and is bounded east by the counties of Aberdeen, Banff, Elgin, and Nairn; south by Perth and Argyllshire; west by the Atlantic and Ross-shire; and north by Ross-shire. Area, 4088 square miles, of which more than two-thirds is barren heath. The county consists chiefly of deer forests, which are rented as hunting ranges. It has valuable coast fisheries. Inverness, the county seat, is the only town. Population, in 1801, 72,700; in 1901, 90,200.

INVERSION (Lat. *inversio*, from *invertere*, to turn about, from *in*, in + *vertere*, to turn). In music this term is applied to intervals, chords, and phrases or passages. An interval is said to be inverted where the position of its two notes is reversed by transposing one of them an octave higher or lower. The inversion changes the name and to some extent the character of the interval. The name or number of an inverted interval will be found by subtracting its original number from nine. Thus a unison inverted becomes an octave, a second becomes a seventh, a third becomes a sixth, and so on, as shown in the following table of inversions:



By inversion, major intervals become minor, and minor become major; diminished intervals become augmented, and augmented become diminished. But the two perfect intervals of the fourth and the fifth remain perfect when inverted. In these examples the transposed note is placed an octave higher, but naturally the same result is arrived at by transposing it downward, as will be seen by reading the table backward. For inversion of chords, see CHORD. For inversion of phrases or passages, see COUNTERPOINT.

INVERSION (in mathematics). See CIRCLE.

INVERT'ASE (from *invert*). One of the enzymes (q.v.) which acts upon certain sugars, especially upon cane-sugar (saccharose), which it hydrolyzes, forming grape-sugar (glucose) and fruit-sugar (fructose). Invertase acts most rapidly at 50° to 60° C., in a slightly acid medium. It can break up practically unlimited quantities of the sugar without being itself materially diminished. Invertase occurs in many fungi and in some bacteria; more recently it has been found widely distributed in the seed-plants, in whose nutritive work it plays an important part, because cane-sugar is probably one of the most widely distributed foods in the higher plants. Invertase is secreted abundantly by yeast, and without it yeast is unable to ferment cane-sugar. After inversion of cane-sugar the products are broken up by the enzyme zymase (q.v.). See FERMENTATION.

INVER'TEBRA'TA (Neo-Lat. nom. pl., from Lat. *in-*, not + *vertebratus*, vertebrate, from *vertebra*, joint, from *vertere*, Skt. *vart*, OChurch Slav. *vrŭtěti*, to turn, Goth. *wairþan*, AS. *weorþan*, OHG. *werdan*, Ger. *werden*, to become). Animals which do not have a vertebral column or spine. The term is used in contrast with Vertebrata (q.v.), or animals with a backbone. One group, then, is formed on positive and the other on negative characters. Before the anatomical structure and the embryological development of animals was very generally worked out, the barrier between invertebrates and vertebrates was supposed to be absolute; but with the refinement of anatomical and embryological methods of study, brought about in a great measure by the use of the microscope, the hiatus between them is nearly bridged over. Ascidians are now considered to be degenerate ancestors of vertebrates; some of the nemertean and chætopod worms approach vertebrates in certain characters, and Balanoglossus and Cephalodiscus (q.v.) are frequently called hemi-chordata (see ADELOCHORDA), because they are so near the boundary line between vertebrates and invertebrates that they can be said to be only half-vertebrates. And not only has this barrier been broken down, but, with our increased knowledge, the absolute independence and isolation of many different groups of invertebrate animals which the earlier systematists believed to exist must be abandoned. The foundation of the zoölogy of these animals, as there defined, was laid by Lamarck (q.v.) in a monumental work, *Système des animaux sans vertèbres*, published in Paris in 1801; followed in 1815-22 by his *Histoire naturelle des animaux sans vertèbres*.

INVEST'ITURE (Lat. *investitura*, from *investire*, to invest, from *in*, in + *vestire*, to clothe, from *vestis*, garment; connected with Gk. *ἐννύναι*, *hennynai*, Skt. *vas*, Goth. *wasjan*, OHG., AS. *werian*, Eng. *wear*). In feudal and ecclesiastical history, the act of giving corporal possession of a manor, office, or benefice, accompanied by a certain ceremonial, such as the delivery of a branch, a banner, or an instrument of office, more or less designed to signify the power or authority which it was supposed to convey. The chief interest is in ecclesiastical investitures, and the contest which arose concerning them is so interwoven with the whole course of mediæval history that a brief account of its nature and origin is indispensable to a right understanding of many of the most important events of that period. The system of feudal tenure had become so universal that it affected even the land held by ecclesiastics, and attached to most of the higher ecclesiastical dignities, monastic as well as secular. Accordingly, ecclesiastics who, in virtue of the ecclesiastical office which they held, came into possession of the lands attached to such offices, were regarded as becoming by the very fact feudatory to the suzerain of these lands; and, as a not unnatural result, the suzerains thought themselves entitled to claim, in reference to these personages, the same rights which they enjoyed over the other feudatories of their domains. Among these rights was that of granting solemn investiture. In the case of bishops, abbots, and other Church dignitaries, the form of investiture consisted in the delivery of a pastoral staff or crosier, and the placing of a ring upon the finger; and as these badges of office were emblematic—the one of spiritual care of souls, the other of the espousals, as it were, between the pastor and his church or monastery—the possession of this right by the lay princes, which they had held since the time of Charles the Great, became in the latter part of the eleventh century a source of disquietude to the Church. On the part of the suzerains it was maintained that they did not claim to grant by this rite the spiritual powers of the office, their functions being solely to grant possession of its temporalities, and of the rank thereto annexed. But the Church party urged that the ceremonial involved the granting of spiritual powers; insomuch that, in order to prevent the clergy from electing to a see when vacant, it was the practice of the emperors to take possession of the crosier and ring, until it should be their own pleasure to grant investiture to their favorites. The investiture strife was complicated by the rebellions of the nobles in Germany; by the strife between rival parties in the Lombard cities; by the conflict of parties in Rome; and specifically by the question of the property of Countess Matilda of Tuscany. (See MATILDA; GERMANY; HENRY IV.) The disfavor in which the practice of investiture was held by the clergy found its most energetic expression in the person of Gregory VII., who, having, in the year 1074, enacted most stringent measures for the repression of simony, proceeded, in 1075, to condemn, under excommunication, the practice of lay investitures, as almost necessarily connected with simony, or leading to it. This prohibition, however, only regarded investiture in the objectionable form in which it was then practiced, or investiture of whatever form, when the office had been obtained simoniacally. But other members of the clergy went much further, and a pope of the same century, Urban II. (1095), absolutely and entirely forbade, not alone lay investiture, but the taking of an oath of fealty to a lay suzerain by an ecclesiastic, even though holding under him by the ordinary feudal tenure. The contest lasted from 1075 to 1122. In the beginning of the twelfth century it assumed a new form, when Pope Paschal II. actually agreed, in 1111, to surrender all the possessions with which the Church had been endowed, and which alone formed the pretext of the claim to investiture on the part of the Emperor, on condition that the Emperor Henry V. give up that claim to investiture. This, however, never had any practical effect; but, the other subjects of contention being removed, the contest was finally adjusted by the celebrated Concordat of Worms in 1122, by the terms of which the Emperor agreed to give up the form of investiture with the ring and pastoral staff, to grant to the clergy the right of free elections, and to restore all the possessions of the Church of Rome which had been seized either by himself or by his father; while the Pope, on his part, consented that the election should be held in the presence of the Emperor or his representative; that investiture might be given by the Emperor, but only *by the touch of the sceptre;* and that the bishops and other Church dignitaries should faithfully discharge all the feudal duties which belonged to their fief.

For the investiture troubles in Germany, consult: Mirbt, *Die Publizistik im Zeitalter Gregors VII.* (Leipzig, 1894); in England, Böhmer, *Kirche und Staat in England und in der Normandie im XI. und XII. Jahrhundert* (Leipzig, 1899); for those in France: Imbart de la Tour, *Les élections épiscopales dans l'église de France du IXème au XIIème siècle* (Paris, 1891); Ibach, *Der Kampf zwischen Papsttum und Königtum von Gregor VII. bis Calixtus II.* (Frankfort, 1884).

INVINCIBLE ARMADA. See ARMADA.

INVINCIBLE DOCTOR, THE (Lat. *Invincibilis Doctor*). A name given to the English theologian William of Occam, on account of his logical methods of argument.

INVINCIBLES (Lat. *invincibilis*, unconquerable, from *in-*, not + *vincibilis*, conquerable, from *vincere*, to conquer; connected with OIr. *fichim*, I fight, OChurch Slav. *věkŭ*, strength, Goth. *weihan*, to fight, AS. *wigend*, OHG. *wigant*, Ger. *Weigand*, warrior). Members of a secret Irish society composed of some of the most desperate spirits of the Fenian association. Each member was acquainted by name with but two others—the one who nominated him to membership, and the one whom he in turn nominated. The chief was a mysterious person known simply as No. 1. The object of the society was the assassination of officials. Consult *Annual Register* (London, 1883). See FENIAN SOCIETY.

INVIOLABILITY (Lat. *inviolabilitas*, from *inviolabilis*, inviolable, from *in-*, not + *violabilis*, violable, from *violare*, to violate, from *vis*, Gk. *ἴς*, *is*, strength, violence). In international law, the freedom or immunity which attaches, to a greater or less degree, to the public vessels and their crews and to the diplomatic agents of one country when within the territory of another State, and also in a very limited degree to merchant vessels in foreign waters. This immunity is extended upon the fiction of exterritoriality (q.v.). With respect to public vessels, it does not allow the granting of asylum (q.v.) to criminals or fugitive slaves, but custom seems to have established the right of such vessels to grant hospitality to political refugees who without invitation come to these vessels and ask for protection. This grant of asylum does not give the right to the foreign State to demand the surrendering of the political refugee nor to expel the ship from its waters. When the commander of the vessel harbors a criminal, resort must be had to a diplomatic appeal; invasion of the ship is not allowed. Should the vessel, however, be made the headquarters of treason, or aid or assist in insurrection or disorders against the State, such measures as are necessary for self-protection may, of course, be taken. Merchant ships have but a slight degree of inviolability, such as that which permits them to regulate their internal discipline by their home laws, certain restrictions on the right of search, etc. From the earliest times envoys or others sent on diplomatic errands from one State to another have been held sacred or inviolate in their persons during their stay. While this has been the general rule, the modern uniform observance of such immunity, as it now exists among civilized nations, is a late development. Formerly it was neither so extensive, nor was it free from frequent violation.

Inviolability attaches at once upon the entrance of the envoy or minister, and extends during his entire residence. While it exists it protects him, his residence and movables, and his suite from the local jurisdiction, civil and criminal. His civil immunity may be waived only by his waiver at the time of his reception, or by his voluntary submission to the jurisdiction of the foreign courts with his sovereign's consent. The residence of the envoy or minister is entitled to absolute immunity from the execution of compulsory process and from all forcible intrusion. He cannot harbor criminals not of his suite, as was the common practice in the Middle Ages; but in barbarous countries and in the South American countries it is customary for asylum to be given to political refugees, although this custom depends rather upon the superior force of the nation represented by the minister than on any general policy of international law. The criminal immunity of a foreign diplomatic agent is suspended only in extreme cases, as when he is party to or aids in plotting or conspiracy against the Government to which he is accredited, in which case he compels its authorities to arrest him in self-defense. In ordinary cases of violation of the criminal law his recall is demanded. Consult Taylor, *International Public Law* (Chicago, 1901), and the authorities noted under INTERNATIONAL LAW.

INVISIBLE EMPIRE. See KU-KLUX KLAN, THE.

INVOCATION OF SAINTS. See SAINTS.

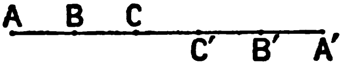
INVOICE (probably from Fr. *envois*, pl. of *envoi*, OF. *envoy*, conveyance, a sending, from *envoyer*, OF. *envoyer*, *envoier*, to send, from Lat. *in*, in + *via*, way). A bill of parcels; a statement in detail of the nature, quantity, and price of certain articles. Although the term is used most frequently in connection with sales of goods, an invoice often accompanies a bailment, as when it is sent to a consignee by a shipper of goods, who has retained title in them by the bill of lading (q.v.). In such cases its function is to inform the consignee that the goods invoiced have been shipped to him, and may become his upon payment of the prices named in accordance with the conditions named in or accompanying the bill of lading. An invoice is not a document of title, and its possession does not indicate that the holder is the owner of the goods therein described. Nor is it a written contract of sale. It is a mere memorandum, always susceptible of explanation by parol evidence. It may be a sufficient memorandum under the statute of frauds (q.v.) if it contains all the material terms of the oral sale contract and is signed by the party to be charged. Invoices of imported goods are required by the tariff regulations of some countries to be verified before one of their consuls or to be vouched for by him. Consult the authorities referred to under SALES; BAILMENTS.

IN′VOLU′CRE (Lat. *involucrum*, wrapper, from *involvere*, to wrap, from *in*, in + *volvere*, to roll; connected with Goth. *walwjan*, AS. *wealwian*, Eng. *wallow*). As a rule, each flower in a cluster (inflorescence) is subtended by a bract. In case the flowers or their pedicels are close together, the bracts are thrown into a rosette, which is called an 'involucre.' Such inflorescences as the umbel of Umbelliferæ and the head of Compositæ have very characteristic involucres. See INFLORESCENCE.

INVOLUTION AND EVOLUTION. In mathematics, the raising to powers and the extraction of roots, respectively. The result of taking a number twice as a factor is called the square of the number; the result of taking it three times as a factor, its cube; four times, its fourth power, and so on; e.g. $3 \,.\, 3 = 3^2$, or 9 is the square of 3; $3 \cdot 3 \cdot 3 = 3^3$, or 27 is the cube of 3; $a \cdot a \cdot a \cdot a = a^4$ is the fourth power of a. This process is called involution. Evolution is the inverse of involution, or it is the process which undoes involution. The square root of a number is one of the two equal factors of the number, the cube root one of the three equal factors, and so on; e.g. the square root of 16, or $\sqrt{16}$, is either 4 or -4, since $4 \cdot 4 = 16$, and $-4 \cdot -4 = 16$; the cube root of 27, or $\sqrt[3]{27}$, is either 3 or $-3(-\frac{1}{2} \pm \frac{1}{2}\sqrt{-3})$ since each of these cubed equals 27. The nth root of a perfect nth power is one of the n equal factors of that power. A number which is not a perfect nth power has not n equal factors. It is, however, said to have an nth root to any required degree of approximation. Thus the nth root of m to 0.1 is that number of tenths whose nth power differs from m by less than the nth power of any other number of tenths.

When the number whose root is sought is a perfect power, the process of factoring is one of the most practical methods except the use of tables. In the case of numbers which are not perfect powers, and of certain algebraic expressions, the binomial formula is usually employed where tables are not available. Thus $a^2 + 2ab + b^2$, the square of $a + b$, may be applied to extract the square root of a number or of an algebraic expression, since the root can always be expressed as a binomial whose square the power contains. The older methods of square and cube root, depending upon the sections of a square and of a cube, were inferior, since they could not be extended to higher roots. The binomial formula is, however, of general application, and may be extended so as to extract the nth root. The detail of these processes can best be obtained from textbooks. Practically to obtain the square or cube root of a number, reference is usually made to tables of roots or of logarithms. See LOGARITHM.

In geometry two collinear ranges, three points each, are said to form an involution, when the anharmonic ratios (q.v.) of any four, not two pairs of *conjugate* points, is equal to the anharmonic ratio of their four conjugates. Thus, in the figure



A, B, C, C′, B′, A′ form an involution, A, B, C being conjugate to A′, B′, C′ and (A B C B′) = (A′ B′ C′ B). This form of involution is due to Desargues (1639). Involutions of higher degrees have been developed by Poncelet (1843) and Möbius (1855).

IO, ī′ō (Lat., from Gk. Ἰώ). In Greek legend, the daughter of Inachus or Iasus, and priestess of Hera at Argos. She was loved by Zeus, who, on account of Hera's suspicions, changed her into a white cow. Hera, having obtained of him the cow as a present, set the hundred-eyed Argus to watch her. Hermes, by command of Zeus, killed Argus and released her. Hera then sent a gadfly, which pursued Io until in her wanderings she reached Egypt, where she was restored to her original form, and became the mother of Epaphus. A somewhat different account of this myth is found in the *Prometheus* of Æschylus. In the early Greek art Io is represented as a cow; about B.C. 500 it became customary to represent her as a maiden with horns on her forehead; later still there is a return to the earlier method. Various attempts have been made to explain the myth by natural phenomena, but none have obtained any general acceptance. Consult, Engelman, *De Ione* (Halle, 1868); id., in Roscher, *Lexikon der griechischen und römischen Mythologie* (Leipzig, 1890-94); Plew, *Neue Jahrbücher für Philologie*, vol. cii. (Leipzig, 1870).

I′ODIDES (from *iodine*, from Gk. *ἰώδης*, *iōdēs*, like a violet, from *ἴον*, *ion*, Lat. *viola*, violet). The salts of hydriodic acid (q.v.). The iodides of potassium, sodium, ammonium, strontium, and zinc, are used in medicine. They are extensively employed in the tertiary stages of syphilis, causing the rapid absorption of syphilitic deposits. The iodide of potassium is further beneficial in gonorrhœal rheumatism, in certain joint diseases, in pleurisy, Bright's disease, asthma, and as an expectorant in bronchitis; it is also used in cases of chronic lead and mercury poisoning. The other iodides have much the same effect as that of potassium, and the iodides of sodium and strontium are even believed to be preferable. Overdoses of iodides, and even moderate doses in the case of some people, may give rise to certain symptoms that are collectively known as *iodism:* there is an eruption on the skin, running at the nose and mouth, sore throat, and even laryngitis and bronchitis. In such cases the dose should be diminished, and, if necessary, the administration of the salt entirely discontinued. Potassium iodide sometimes causes great general depression; if so, it may be replaced by the iodide of sodium or of strontium, or preferably by free hydriodic acid.

I'ODINE (from Gk. ἰώδης, *iōdēs*, like a violet, so called from the color of its vapor). One of the 'halogen' elements, similar to chlorine and bromine. It was discovered by Courtois in 1811, in the ashes of seaweeds. It has been found free in nature, but occurs chiefly in combination, and is thus widely distributed both in the organic and inorganic kingdoms. It exists in sea-water, in sea plants and animals, and in mineral springs. Along with lead, mercury, silver, and zinc it occurs in ores from Chile, Mexico, and Spain. It is largely obtained from seaweeds, especially those thrown up on the north coast of France, the coasts of Spain and Ireland, and the west coast of Scotland. When burned (formerly in the open air, now in closed retorts to prevent loss by volatilization) these weeds yield an ash called *kelp*, which contains from 0.1 to 0.3 per cent. of iodine. The kelp is dissolved in hot water, and the solution is evaporated until the bulk of the sodium carbonate contained in it has crystallized out. An excess of sulphuric acid is then added to the mother-liquor, and thus hydriodic acid is set free. Manganese dioxide (an oxidizing agent) is now added to the liquor in the distilling apparatus, and thus the iodine is liberated. The product can be readily purified by sublimation, the first and last portions only being very impure. The crude sodium nitrate from Peru and Chile, which contains about 0.2 per cent. of sodium iodate, is another important source of iodine. The iodine is extracted from the mother-liquors from which the sodium nitrate has been separated by crystallization. These are run into wooden vats lined with lead, and the iodine is precipitated by a mixture of neutral and acid sodium sulphites. The resulting iodine is then washed with water and pressed into thick cakes, which are further purified by sublimation.

Iodine (symbol, I; atomic weight, 126.85) is a grayish-black soft solid, with a metal-like lustre. It has a specific gravity of 4.9 at 60° C., melts at about 114° C., and boils at 184° C., giving rise to a very heavy violet vapor with a peculiar and penetrating odor. Iodine finds extensive use in the arts, especially in the manufacture of coal-tar colors. Some iodine is used in photography. But the greater portion of the iodine of commerce is employed in medicine, partly in the free state, partly in combination as iodoform, and as the iodides of potassium, sodium, ammonium, strontium, and zinc, all of which are official in the Pharmacopœia. Iodine itself is but little used internally, although repeated small doses of it, in form of the tincture well diluted with water, are often successfully used to stop vomiting. Externally, however, iodine is in constant use as a disinfectant, irritant, counter-irritant, and parasiticide. The pharmacopœial preparations are: (1) *Compound solution of iodine*, or Lugol's solution; an aqueous solution, 100 parts of which contain 5 parts of iodine and 10 parts of potassium iodide. (2) *Tincture of iodine*, which is a 7 per cent. solution of iodine in alcohol. (3) *Iodine ointment*, which contains 4 per cent. of iodine, 1 per cent. of potassium iodide, 93 per cent. of benzoinated lard, and 2 per cent. of water. When applied to the skin, the preparations produce a stain, which disappears in time, largely owing to the volatility of iodine; the stain may, however, be readily washed off with alkalies or with sodium hyposulphite. As counter-irritants the preparations mentioned are used for pleurisy, chilblains, chronic inflammation of the joints, etc. As an antiparasitic, iodine is often used for ringworm, in the form of *Coster's paste*, which is made from 1 part of iodine and 4 parts of wood-tar. For the medicinal uses of iodides, see IODIDES.

Iodine is but sparingly soluble in water, 5000 parts of water dissolving only one part of the element. It is quite soluble in alcohol, and even more freely in ether. But it dissolves with great ease in hydrocarbons, in carbon disulphide, and in chloroform. It is also freely soluble in iodine derivatives of the hydrocarbons, and in aqueous solutions of metallic iodides; but its solubility in all such substances is probably due to its supposed capacity for forming with them true chemical compounds. Among the compounds of iodine may be mentioned hydriodic acid and its salts (see IODIDES), iodic acid (HIO_3) and its salts, termed iodates, and periodic acid (HIO_4) and its salts, termed periodates. The anhydride of iodic acid is iodine pentoxide. The well-known compound of iodine with nitrogen is mentioned under the latter name. Very interesting are two compounds of iodine with chlorine—viz. the monochloride of iodine, ICl, and the trichloride of iodine, ICl_3, both of which may be prepared by the direct action of chlorine on iodine. The trichloride has been recommended as an antiseptic.

It was mentioned above that iodine volatilizes very readily. The density of its vapor has been studied by Dumas, Victor Meyer, Crafts, of Boston, and Troost, of Paris. It will be remembered that, according to Avogadro's rule, the molecular weight of a substance equals twice its vapor density referred to hydrogen. Up to about 800° C. iodine vapor is found to be invariably about 127 times as heavy as hydrogen under the same conditions of pressure and temperature. Hence the molecular weight of iodine up to 800° C. is about 254; and as the atomic weight of the element is about 127, the molecule of iodine vapor is considered as made up of two atoms and is represented by the symbol I_2. Above 800° C., however, iodine vapor grows lighter and lighter. At 1000° C. it is only 100 times as heavy as hydrogen; at 1400° C. only 75 times as heavy; and at 1500° C., and under reduced pressure, Dr. Crafts found it to be only 66 times as heavy as hydrogen under the same pressure and temperature. This indicates that the molecular weight of iodine vapor gradually diminishes above 800° C., seemingly approaching the limit 127 (i.e. 2 × 63.5), which is the relative weight of single atoms. In other words, the molecules of iodine seem to become gradually dissociated into single atoms, and at some limiting temperature and pressure which have not yet been found, the particles of the vapor would all be single atoms. The phenomenon, which has also been observed in the case of certain other elements, presents considerable interest from many points of view. Van 't Hoff thinks that if the chemical elements can at all be decomposed, the method might be like that employed in bringing about the phenomenon just described.

Consult "Untersuchungen über das Jod von Gay-Lussac," in Ostwald's *Klassiker der exakten Wissenschaften* (Leipzig, 1889).

IODISM. See IODIDES.

IOD'OFORM, or TRI-IODO-METHANE, CHI_3. A chemical compound of carbon, hydrogen, and iodine, analogous to chloroform (q.v.). It is a yellow crystalline substance, having a penetrating sweetish odor and an unpleasant sweetish taste. It is very soluble in ether, moderately so in alcohol, and but very sparingly in water. It melts at 119° C. (246.2° F.), and can be readily distilled in a current of steam, although it undergoes decomposition if distilled alone. It also undergoes gradual decomposition under the action of light. It is produced when iodine comes in contact, in the presence of alkalies, with various organic compounds of the fatty series, such as ordinary alcohol, aldehyde, acetone, etc. Its preparation may be conveniently carried out as follows: Dissolve some caustic soda or caustic potash in alcohol diluted with water; warm this solution gradually, add iodine to it, and separate the precipitated iodoform by filtration. The filtrate contains considerable quantities of sodium or potassium iodide, and sodium or potassium iodate. These may either be recovered entirely, in the form of iodides, or else more alcohol and more caustic soda or potash may be added to the filtrate and a slow current of chlorine passed through it, the iodine of the salts being thus set free to form further quantities of iodoform. Another convenient method of preparing iodoform consists in gradually adding an aqueous solution of sodium hydrochlorite to an alkaline solution of potassium iodide in dilute aqueous acetone. Finally, iodoform may be manufactured by subjecting to electrolysis a solution of potassium iodide and acetone (or alcohol) in water with a current of carbonic-acid gas passing into the solution. The principal use of iodoform is for purposes of antisepsis, disinfection, and local stimulation. It has been demonstrated that iodine itself really exerts no antiseptic action whatever, and is incapable of preventing the development of micro-organisms. When, however, it is brought in contact with a wound, the secretions of the latter speedily decompose it, and it is the decomposition products that possess the well-known antiseptic and disinfecting power. Iodoform, in the form of powder, of an ointment, or of its solution in collodion, is extensively used as an application for syphilitic and tuberculous ulcerations, as well as for sores and wounds of any other kind. One of the disadvantages of iodoform is its disagreeable odor. But this may be masked by the addition of some musk, or by dissolving iodoform in volatile camphor oil or in balsam of Peru. Iodoform is rapidly absorbed from raw surfaces, and this sometimes gives rise to symptoms of poisoning, and has even caused death. The symptoms vary in different cases, and may include any two or three of the following: Quick pulse, fever, collapse, dilated pupils, erythema, hallucinations, and gastro-intestinal irritation. The treatment consists in administering stimulants and diaphoretics, and sponging the skin with warm water. A substance termed *di-iodoform* has been introduced as a substitute for iodoform. See ACETYLENE.

IOLA, ī-ō'lȧ. A city and the county-seat of Allen County, Kan., 109 miles south by west of Kansas City, Mo.; on the Neosho River, and on the Missouri Pacific, the Missouri, Kansas and Texas, and the Atchison, Topeka and Santa Fé railroads (Map: Kansas, G 4). Owing to vast wells of natural gas, the city has grown rapidly, and is showing a substantial industrial development. It has immense zinc-smelters, zinc-rolling mills, cement-works, brick plants, a sulphuric-acid plant, foundry and machine-shops, and a wholesale trade in groceries, flour, and confections. Settled in 1857, Iola received a charter as a city of the second class in 1898, and is governed by a mayor, elected biennially, and a unicameral council. It owns and operates its water-works and electric-light plant. Population, in 1890, 1706; in 1900, 5791.

I'OLAN'THE. An operetta by Sir Arthur Sullivan with libretto by W. S. Gilbert (1882). The plot rests on the love story of Strephon, a poor suitor who is half a fairy, and Phyllis, a ward in chancery. The humorous element is supplied by the intervention of fairies. The music is attractive, and the opera has been one of the most popular of the authors' productions.

I'OLA'US (Lat., from Gk. Ἰόλαος). In Greek mythology, the half-brother and charioteer of Hercules, whom he assisted in the destruction of the Lernæan hydra and in other contests. For his good offices Megara, the first wife of Hercules, was given to him. He also aided the children of Hercules against Eurystheus, and was worshiped with the hero at Thebes.

I'OLITE (from Gk. *ἴον*, *ion*, violet + *λίθος*, *lithos*, stone), CORDIERITE, or DICHROITE. A hydrated magnesium-iron-aluminum silicate that crystallizes in the orthorhombic system. It is found in various shades of blue, and is transparent to translucent. Iolite is found in Bavaria, Hungary, Tuscany, Brazil, and in Ceylon, where crystals of an intense blue color, called *saphir d'eau*, are found. In the United States dark-blue specimens occur at Haddam and Norwich, Conn., and elsewhere in New England. They have been cut as gems.

ION, ī'ŏn (Lat., from Gk. *Ἴων*). A tragedy of Euripides, the chief interest of which consists in Creusa's attempt to poison Ion, who had been brought up in Apollo's temple at Delphi, and is given to Creusa and her husband as a son. When detected, Creusa is threatened with death at the hands of Ion, who is finally revealed to her as her son by Apollo. The date of the play is uncertain.

ION. See DISSOCIATION; IONIZATION; ELECTRO-CHEMISTRY, GENERAL; SOLUTION; ELECTRICITY.

IONA, ī-ō'nȧ (OI. *Hi*, *Hü*, *I*, island, whence the oldest Latin form *Ioua*, corrupted in transcription to *Iona*). A celebrated island of the Hebrides, in Irish ICOLMKILL. It is situated on the west coast of Scotland, a short distance from Mull and Staffa, and forms part of Argyllshire. It is about three miles long, varying in breadth from a mile to a mile and a half. Its area is estimated at 2000 acres, of which rather more than a fourth part is under tillage. The soil in some parts is fertile, and yields oats, barley, and potatoes in abundance. Dunii, the highest point of the island, is 330 feet above the sea-level. Population, about 250.

The history of the island begins in the year 563, when Saint Columba (q.v.) landed upon Iona with twelve disciples. Having obtained a grant of the island from his kinsman, Conall, King of the Scots, and later from Bruide, King of the Picts, he built upon it a monastery, which was long regarded as the mother church of the Picts, and was venerated not only among the Scots of Britain and Ireland, but among the Angles of the north of England, who owed their conversion to the missionaries of Iona. From the end of the sixth to the end of the eighth century the monastery of Iona was scarcely second to any monastery in the British Isles. The island was several times invaded between the eighth and tenth centuries by the heathen Norsemen, and the buildings were burned and the monks slaughtered. Toward the close of the eleventh century the monastery was repaired by Saint Margaret, the wife of King Malcolm Canmore, and was visited in 1097 by King Magnus the Barefooted, of Norway. It was now part of that kingdom, and so fell under the ecclesiastical jurisdiction of the Bishop of Man and the Archbishop of Trondhjem. In 1203 the bishops of the north of Ireland disputed the authority of the Manx bishop, pulled down a monastery which he had begun to build in the island, and placed the abbey under the rule of an Irish Abbot of Derry. The Scottish Church had long claimed jurisdiction in Iona, and before the end of the thirteenth century the island fell under the rule of the Scottish King. Its abbey was now peopled by monks of Cluny, and a nunnery of Austin canonesses was planted on its shores. At the beginning of the sixteenth century the island again became the seat of the bishopric of the isles. No remains of Saint Columba's monastery now exist. The most ancient ruins are those of the Benedictine monastery of 1203. Saint Oram's Chapel, now the oldest church in the island, may probably be of the latter part of the eleventh century. Saint Mary's Nunnery is, perhaps, a century later. The cathedral of Saint Mary's Church seems to have been built chiefly in the early part of the thirteenth century. It has a choir with a sacristy on the north side and chapels on the south side; north and south transepts; a central tower, about 75 feet high; and a nave. An inscription on one of the columns appears to show that it was the work of an Irish ecclesiastic who died in 1202. On the north of the cathedral are the chapter-house and other remains of the conventual or monastic buildings. The 'Reilig Oran,' or ancient burial-ground, is supposed to contain bodies of a number of Irish, Scotch, and Danish kings, but no monuments of these princes now remain. Consult Fowler, *Adamnani Vita S. Columbæ* (Oxford and London, 1898).

IONI, or INIES. A small tribe of American Indians, originally (till 1846) on the Brazos River, Tex., and afterwards on the Wichita Reservation, Oklahoma.

IO'NIA (Lat., from Gk. 'Ιωνία, earlier 'Ιαονία, *Iaonia*, for *'Ιαϝονία, *Iavonia*, Skt. *Yavana*). The ancient name of the district occupying the centre of the western coast of Asia Minor from (approximately) the River Hermus in the north to Mount Latmus in the south. It received its name from the Ionians, who, according to the mythological account, derived theirs from Ion (q.v.), the son of Apollo by Creusa, a daughter of a King of Athens. According to the usually received tradition, they were driven out of the Peloponnesus by the Dorians, and removed to Attica, whence bands of them went forth to settle on the coast of Asia (see below in the account of the Ionians). Here in historical times we find a league of twelve cities, whose centre was the *Panionium*, a sanctuary of Poseidon Heliconius on the promontory of Mycale. The twelve cities, beginning at the north, were Phocæa, Clazomenæ, Erythræ, Chios (island), Teos, Lebedos, Colophon, Ephesus, Samos (island), Priene, Myus, Miletus. The cities flourished and sent out many colonies both to the north along the Propontis and Black Sea, and to the west. During the seventh century B.C. they suffered from the Cimmerian invasion of Asia Minor, and later were involved in wars with the Lydian kings, to whom in the sixth century they seem to have yielded a nominal submission, and in turn to have exercised a powerful influence upon Lydian art and life. The Persian conquest of Lydia, about B.C. 546, led to the reduction of the Ionian and other Greek cities. They were left to the government of their own tyrants, and merely paid a regular tribute, though nominally under the Satrap of Lydia and Ionia, whose residence was at Sardis. About B.C. 500 the Ionian cities revolted from Persia. The insurrection collapsed with the naval victory of the Persians at Lade in B.C. 494 and the fall of Miletus in the same year. The aid lent to the Ionians by the Greeks gave Darius a pretext for his onslaught upon Greece. On the defeat of the Persians at Mycale by the Athenians and Spartans (B.C. 479), the cities of Asia Minor again revolted, and joined the Delian League. They remained dependent on Athens until the close of the Peloponnesian War (B.C. 404), when they quickly fell under Persian rule again, where they remained till the conquests of Alexander the Great. From this period Ionia shared the fate of the neighboring countries, and in B.C. 64 was added to the Roman Empire by Pompey, after the third Mithridatic war. In later times it was so ravaged by the Turks that few traces of its former greatness are now left.

The name Ionian was not confined to the Greeks of Ionia. In historic times it denoted one of the great divisions of the Greek race, occupying Attica and Eubœa, and the most of the islands of the Ægean, as well as the stretch of coast in Asia Minor, and, of course, the colonies sent from these regions. It seems probable that these were the first Greeks known to the East, as their name was adopted by Eastern nations to denote the Greeks. They were distinguished by a dialect distinct from the Dorian and North Greek, though containing several varieties, and seem also to have possessed greater artistic and literary ability, though also a greater tendency to luxury and ease, and a less vigorous and hardy character. It is generally believed that they came from the mainland of Greece, and gradually spread over their later territory. The movement may well have begun as early as the twelfth century B.C., but probably received its main impulse from the Dorian invasion, and its attendant migrations. This view was opposed by E. Curtius, who declared the Ionians had originally come into Asia Minor from the north and crossed from there to the islands and Attica. More recently Bury, while admitting that the Ionians of history came from

Greece, has maintained that the name is derived from the Asiatic tribe which they found in occupation of the coast. Curtius's view, though held by Holm in his *History of Greece*, is now generally discredited, nor is Bury's theory as yet more than an ingenious hypothesis. That the race was composed of many elements cannot be doubted, and indeed was recognized by the Greeks themselves. Herodotus, while defining Ionians as those who traced their origin to Attica, and celebrated the festival of the Apaturia (see GREEK FESTIVALS), admits that neither Ephesus nor Colophon kept this feast, a fact which seems to indicate a considerable foreign element in these cities. In art, literature, and philosophy, Ionia enjoyed deserved distinction. Her great names are, among others, Mimnermus, Anacreon of Teos, Thales, Apelles, Parrhasius, Zeuxis, and others mentioned under IONIAN SCHOOL. Consult the histories of Greece, especially those of Busolt and Ed. Meyer, in *Geschichte des Altertums*, vol. ii. (Halle, 1894); also Curtius, *Die Ionier vor der ionischen Wanderung* (Berlin, 1855); Ed. Meyer, *Forschungen zur alten Geschichte*, vol. i. (Halle, 1892); Bury, in *English Historical Review* (London, 1890).

IONIA. A city and the county-seat of Ionia County, Mich., 34 miles east of Grand Rapids; on the Grand River, and on the Detroit, Grand Haven and Milwaukee and the Pere Marquette railroads (Map: Michigan, H 6). It is surrounded by a farming and lumbering section, and has wagon-works, car-shops, and shirt and clothing factories. The State House of Correction and the State Asylum are situated here. Ionia was laid out in 1833, and incorporated in 1873. Under the revised charter of 1897 the government is administered by an annually elected mayor, and a unicameral council, of which the executive is a member. The city owns and operates its water-works. Population, in 1890, 4482; in 1900, 5209.

IONIAN ISLANDS. A collective name given to the islands in the Ionian Sea (together with the island of Cerigo farther south) belonging to Greece. They consist of six principal and a large number of smaller islands, and fall mainly into three groups (Map: Greece, B 3). The first and northernmost group lies off the west coast of Epirus, and consists of Corfu and the little island of Paxos; the second group lies around the entrance to the Gulf of Corinth, and consists of Santa Maura, Ithaca, Cephalonia, and Zante; the third group, consisting of Cerigo and its dependent islets, lies southeast of the Morea. The distance from the mainland to Santa Maura, the nearest of the larger islands, is scarcely more than a mile, while the distance to Cephalonia is 22 miles. There is little geographical unity between the islands; for geographical descriptions, see articles on the separate islands. Politically the western groups form the three nomarchies of Corfu, Cephalonia, and Zante, while Cerigo belongs to the nomarchy of Argolis. Their combined area is 1117 square miles, and their population in 1896 was 266,223.

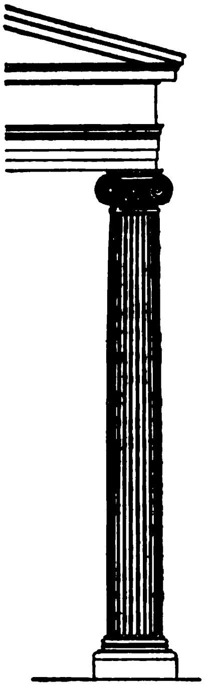
The collective term 'Ionian' is of modern date. After the division of the Roman Empire these islands were included in the eastern half, the Byzantine Empire, and so continued till 1081, when they fell into the power of Robert Guiscard, the Norman ruler of Apulia and Calabria. In the thirteenth and fourteenth centuries the possession of the islands was disputed by the Venetians, the rulers of Naples, and the Greek and Italian corsairs of the Mediterranean. In 1386, however, Venice obtained possession of Corfu, the most important of the islands. By conquest and purchase, the other islands of the Ionian group were acquired by the Republic, Cerigo, the last, being taken from the Turks in 1717. The islands were taken by France when Bonaparte extinguished the Venetian Republic in 1797. They were seized by Russia and Turkey in 1799, but were returned to France under the arrangement made in the Peace of Tilsit in 1807. Zante, Cephalonia, and Cerigo were seized by Great Britain in 1809, though Corfu did not yield till 1815. The islands were reconstituted a republic under a British protectorate. The government was composed of the British high commissioner and an assembly composed of two chambers, the Senate of six, the Legislative Assembly of forty members. Up to 1848 the press was restricted, and the Government was really a despotism, but in that and the following year widespread dislike of the English Government became apparent. To remove what were supposed to be grievances, Lord Seaton, then high commissioner, introduced sweeping changes in the Constitution, including vote by ballot, lowering of the franchise, and freedom of the press. A demand was then made for annexation to the Kingdom of Greece, and an insurrection broke out in August, 1849, in Cephalonia. It was suppressed by Sir Henry Ward, who had succeeded Lord Seaton. Fresh concessions were granted, but without appeasing the malcontents. In 1858 Mr. Gladstone was sent as a special commissioner to the islands, and he reported against their cession to Greece. There was no great desire, however, on the part of the English Government to continue their connection with the Ionian Islands. They had cost the United Kingdom £100,000 per annum, and had been a continual source of annoyance. In 1863 the election of Prince George of Denmark as constitutional King of Greece gave England an opportunity of getting rid of this troublesome dependency. In that year the Parliament of the islands proclaimed their annexation to Greece. On March 29, 1864, a treaty was concluded at London, by which this annexation was consummated, and on May 30th formal possession was taken by the Greek authorities. In February, 1867, the islands were visited by a series of earthquakes, most violent in Cephalonia, where they caused great destruction of life and property, and almost destroyed the two chief towns. See GREECE.

IONIAN SCHOOL. The earliest school of Greek philosophy, represented by Thales, Anaximander, and Anaximenes of Miletus, and Heraclitus of Ephesus. Its chief problem was the search for the first principle in nature, which different exponents of the school found in water, fire, air, or atoms.

IONIAN SEA. The name of that part of the Mediterranean which separates Southern Italy and Sicily from Albania and Greece (Map: Greece, A 3). It is connected with the Adriatic by the Strait of Otranto. Its main arm is the Gulf of Taranto, between the Calabrian Peninsula and that of Otranto, and it forms a number of deep inlets on the coast of Greece, the chief of which is the Gulf of Corinth.

IONIC DIALECT. See Greek Language.

IONIC ORDER. One of the three orders of Greek architecture, so called because it was first and principally used in the Greek cities of Asia Minor. It is not a development of the Doric order, as was formerly supposed, but was coexistent with it. It is of a more elaborate character than the Doric. The base of the column consists of a plain, square plinth, two trochili, with moldings, and a torus fluted horizontally. The shaft is more slender than the Doric, the height varying from eight to ten times the lower diameter of the shaft, and the entasis is slight. It contains twenty-four semicircular flutes, deeper than in the Doric shaft. The capital is composed of an ovolo, enriched with egg-and-dart molding, and of a spiral roll, resembling a cushion, the ends of which are called volutes. Above this roll is a very low abacus, connecting the capital with the architrave. The latter usually consists of three bands, crowned by a cornice enriched with moldings. The frieze is an uninterrupted surface, often decorated with sculpture in relief, and the cornice has two divisions: a projecting block, divided into cogs and dentils, above which still farther projects the corona, capped with moldings.


IONIC ORDER.

In the buildings of Attica a special variety of the Ionic order, called the Attic-Ionic, was used. In this the base consists of two tori and only one trochilus—a debasement of which form was adopted by Roman architects, and is now generally used. The Attic cornice is without dentils. A very beautiful but unique example of the Attic-Ionic order, widely imitated at present, is that of the Erechtheum (q.v.) at Athens. In this the upper part or necking of the shaft is enriched by an exquisite band of floral ornaments, and the channel of the spiral roll of the capital is double, while between the roll and the ovolo there is a torus of braided pattern.

The Ionic order was generally used in the Greek cities of Asia Minor for peripteral temples (as at Ephesus, Priene, etc.), but in Greece proper its use was confined to small prostyle and amphiprostyle buildings (Temple of Wingless Victory, Athens), for circular buildings (Philippeum at Olympia), and in the interior of Doric temples (Bassæ, Tegea). There was, however, a general increasing tendency to use it in Greek architecture. The principal change in its form was in that portion of the spiral roll which connects the volutes. In the best period this was curved, but later it became a straight line—a degradation which was adopted by Roman architects, and is still generally used. See Column, and the special articles on the technical terms mentioned.

I'ONIZA'TION (from *ion*, from Gk. *ἰών*, pres. part. of *ἰέναι*, *ienai*, to go). The modern theory of electric conduction is that an electric current consists of the motion of minute particles of matter which are charged positively and negatively, the motion of the oppositely charged particles being in opposite directions. These charged particles are called 'ions,' and they are in no case identical with molecules; in fact, there is no evidence of a molecule as such being charged. The formation of these ions is called ionization. In metals and all solid conductors there are ions probably always present, but in what state it is not known. In a liquid ions are produced by dissolving in it some salt or acid, which 'dissociates' in the act of solution (q.v.). In ordinary gases ions are probably always present to a limited extent, although in a pure dry gas there may be none; but in any case their number may be enormously increased in many ways. If the Röntgen or X rays (q.v.) are passed through a gas, it is ionized, as is shown by its becoming a good conductor; similarly, if uranium rays (q.v.) or rays from any radio-active substance, or ultra-violet light, or the cathode rays pass through a gas, it is ionized. If the temperature of certain gases is raised, they become conductors; or if a spark is passed between two balls joined to an electrical machine or induction coil, the gas on all sides becomes a conductor; if there is a 'brush discharge' off points, the same is true. Many gases when formed by electrolysis in liquids are found to be ionized.

The whole subject of ionization is still under investigation; but several facts seem to be now assured:

(1) The ions are not molecules.

(2) The negatively charged ions have less mass than the positively charged ones, and move more rapidly under the action of a given electric force.

(3) The ionization of any one gas, however produced, gives the same result; e.g. the ions of oxygen gas are always the same.

(4) The negatively charged ions of all gases are identical.

It seems probable, but not certain, that the charge carried on an ion of any substance in the gaseous state is the same as that carried on an ion of the same substance in a liquid, e.g. a hydrogen ion in hydrogen gas, and a hydrogen ion produced by dissolving sulphuric acid in water. The masses of the ions in the two cases are quite different, the gaseous one being about one-thousandth as heavy as the other. (It may be that in the case of the liquid-electrolyte the ion drags with it a quantity of uncharged matter.)

According to the latest experiments of J. J. Thomson, the mass of a negatively charged ion is of the order 10^{-19} grams; the ratio of this mass to the charge carried is about 10^{-7}, the charge carried by each ion being about 6.5×10^{-10} electrostatic units.

It requires energy to ionize a gas, and some experiments of Rutherford give as an approximate value of the number of ergs necessary to ionize a gas 1.9×10^{-10} ergs per ion. Similarly in the ionization of a salt or acid by going into solution, there are energy changes. It has been estimated that the amount of energy required to ionize 63 grams of copper in a liquid electrolyte is approximately 17,700 calories or 74,340 joules; while, when 65 grams of zinc are ionized, 33,100 calories, or 139,000 joules, are liberated. (63 grams of copper and 65 grams of zinc are 'equivalent' amounts.)

ION (I′ŏn) **OF CHIOS,** kī′ŏs (c.500-c.422 B.C.). A Greek author, who came to Athens when he was still young (B.C. 478). He was a member of the circle which included Cimon and Pericles, and was probably personally acquainted with Æschylus and Sophocles. His only work in prose, so far as we know, was the 'Επιδημίαι, reminiscences of celebrated visitors at Chios, which was of great importance to the Greek historians who succeeded him, and has some value for literary history. The fragments of this work may be found in Müller, *Fragmenta Historicorum Græcorum* (1853). There is also a tradition that he wrote on the colonization of Chios. But his poetry was even more important; he wrote tragedies, lyrics, and elegiac and dithyrambic verse. Consult: Nauck, *Tragicorum Græcorum Fragmenta* (1889); and Bergk, *Poetæ Lyrici Græci* (1900).

I′OPHON (c.450-c.390 B.C.). A Greek tragedian, son of Sophocles. We know little of his life or of his plays. There is a statement in Valerius Maximus attributing the *Antigone* to him. The story that he accused his aged father of insanity so that he might have control of his property, and that Sophocles proved his sanity by reading to the judges from the *Œdipus*, is unsupported by any evidence. The few verses of Iophon which survive may be found in Nauck, *Tragicorum Græcorum Fragmenta* (1889). Consult Wolf, *De Iophonte Poeta* (1884).

I′OS, or **NI′O.** One of the Cyclades, Greek Archipelago, situated about 13 miles south of Naxos (Map: Greece, G 5). Its area is over 45 square miles and its surface very mountainous. The inhabitants cultivate olives and the vine, and raise cattle. The only town, Ios, has a population of 2000. According to local tradition, Homer was buried on the island.

IO′TA (Lat., from Gk. *ἰῶτα*, from Phœnician *yōdh*, Heb. *yād*, Ar. *yad*, hand). The ninth and smallest letter of the Greek alphabet, corresponding to the English *i*.

I. O. U. (I owe you). A memorandum of debt or due bill, named from its abbreviated form, viz.:

New York, January 1, 1903.

John Doe, I. O. U. $20.

Richard Roe.

In England and in most of our States, it is not treated as a *promissory note* (q.v.) because it does not contain an express promise to pay. By statute or by judicial decisions in some States an I. O. U. is declared to be a promissory note. See Due Bill.

IOWA, ī′ō-wȧ (popularly known as the 'Hawkeye State'). One of the North Central States of the United States. It lies between latitudes 40° 36′ and 43° 30′ N., and between longitudes 89° 5′ and 96° 31′ W., and is bounded on the north by Minnesota, on the east by Wisconsin and Illinois, from which States it is separated by the Mississippi River, on the south by Missouri, and on the west by Nebraska, from which it is separated by the Missouri River, and by South Dakota. Its shape is nearly that of a rectangle, measuring 310 miles from east to west and 205 miles from north to south; its area is 56,025 square miles, and it ranks twenty-second in size among the States of the Union.

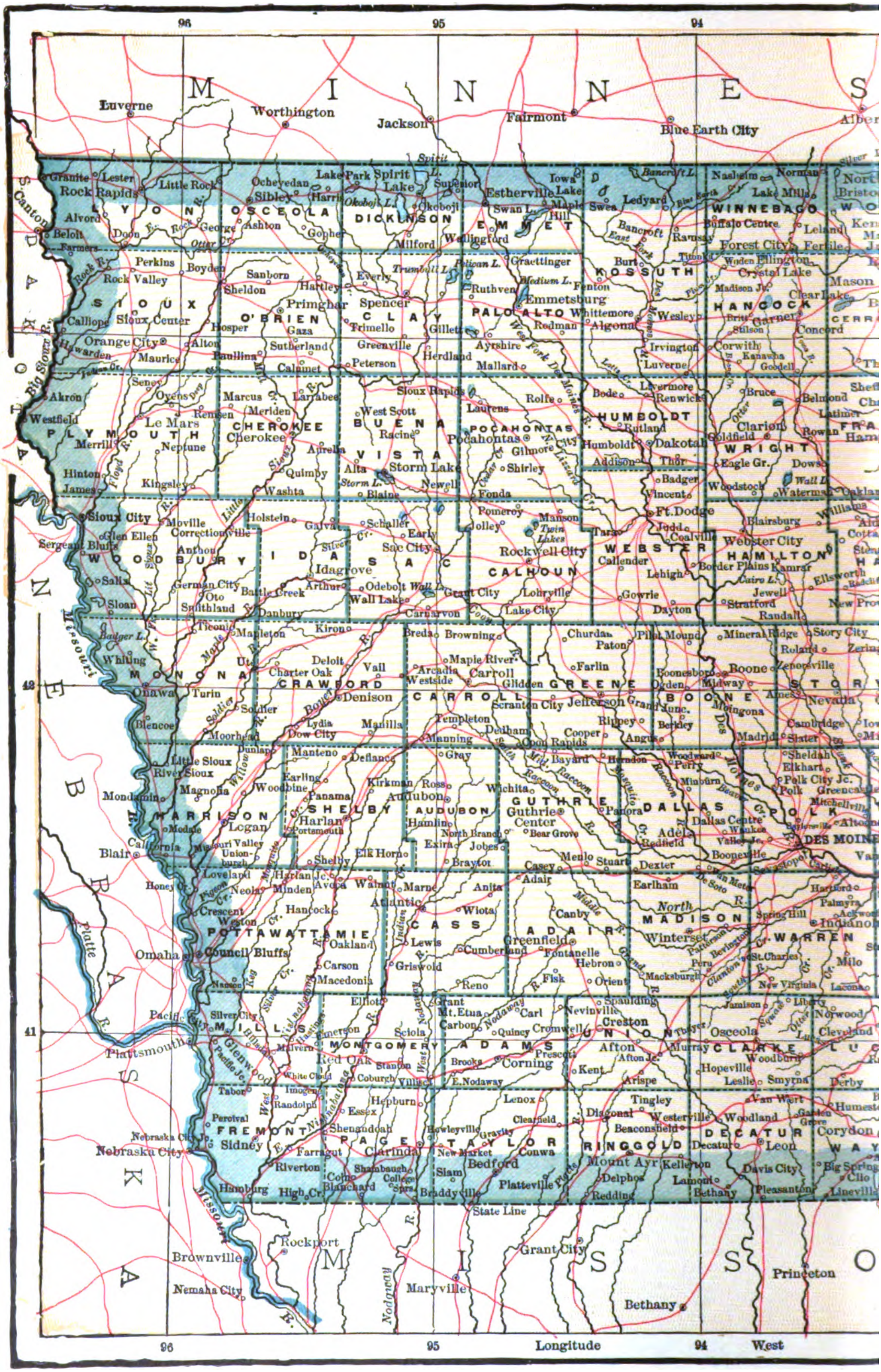
Topography. Iowa lies entirely within the great central prairie belt. Its surface is a plateau with an average height of 1000 feet in the northwestern corner of the State, the highest point, Waneta in O'Brien County, being 1562 feet above sea-level. The plateau slopes gradually in gently rolling prairies toward the southeast, where its average altitude is about 400 feet. It is only where the rivers have eroded their channels through the glacial drift, forming steep bluffs, and in some places rocky cañons, that the country is at all rugged. The greater portion of its area, though not perfectly level, is so free from natural obstructions that the country roads are laid out in squares, crossing at right angles with the absolute regularity of a checker-board. The State is divided into two hydrographic systems, the eastern two-thirds being drained by the direct affluents of the Mississippi, and the western third by those of the Missouri. The divide between the two systems runs obliquely across the State from northwest to southeast. From this the Mississippi affluents flow all in a southeast direction, and the Missouri affluents all to the southwest. The principal of the former are the Turkey, Wapsipinicon, Red Cedar, Iowa, Skunk, and Des Moines rivers, the last being the largest river within the State. The principal Missouri affluents are the Big Sioux, forming most of the South Dakota boundary, the Little Sioux, the Nishnabotna, and the Nodaway. Many of these streams are navigable for very small craft, but, owing to the railroads, they are unnecessary as waterways and little used. Like all typical glaciated areas, Iowa is dotted, especially in the northern part, with numerous small but often beautiful lakes, several of which are favorite resorts, such as Spirit Lake in Dickinson County near the north boundary, a beautiful sheet of water, 2½ by 5 miles, with picturesque, wooded shores. Forest areas are small in Iowa; they are chiefly confined to the faces of the bluffs along the river-courses. The most common trees are the oak, elm, cottonwood, hickory, and maple, while scanty forests of pine and cedar are found on some of the bluffs. Grasses are the predominating feature of the landscape as well as of the flora of the State.

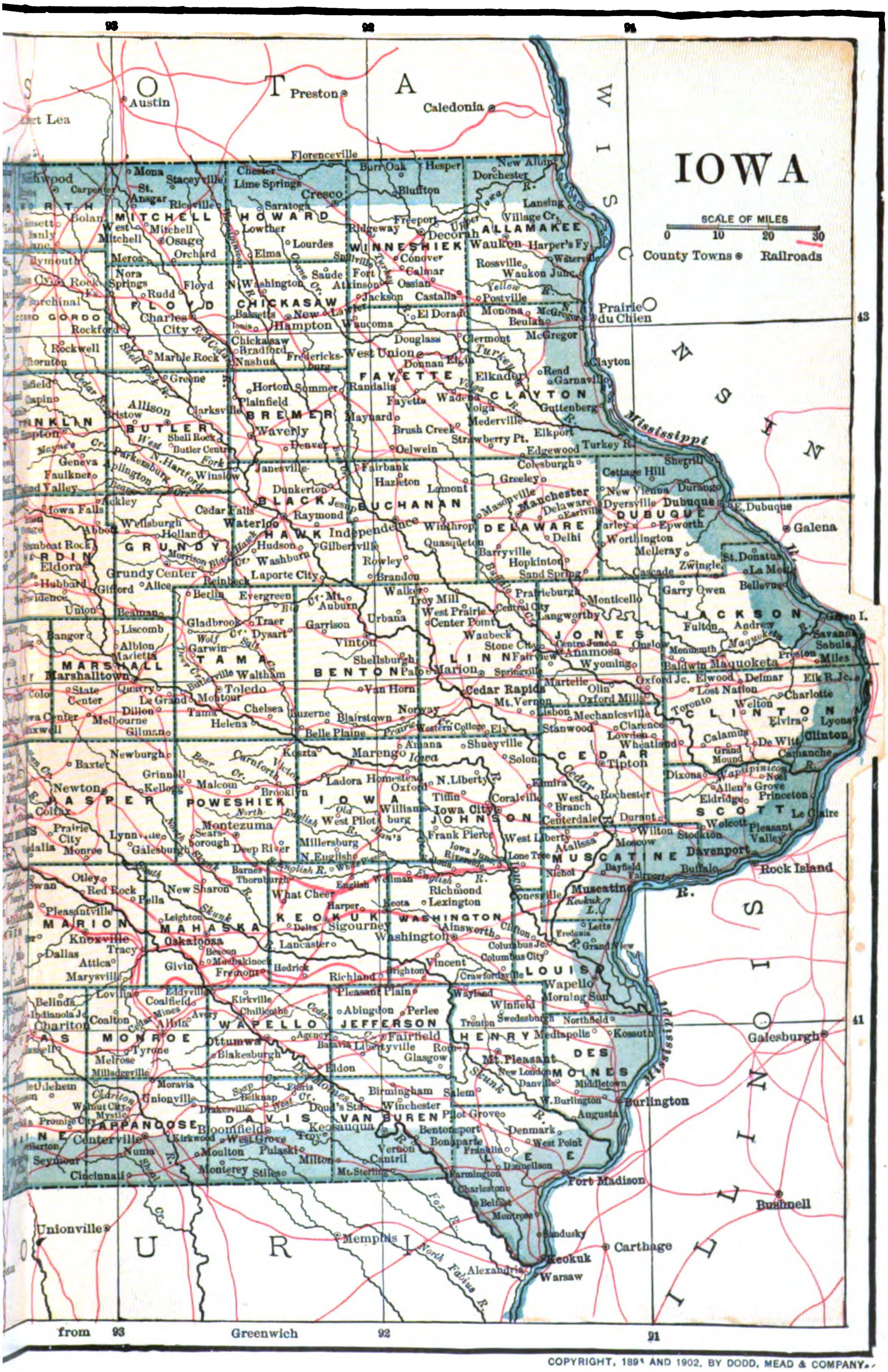
Climate and Soil. The climate in different parts of the State shows only slight variations, which are due to differences in latitude and altitude. It is of the continental type, with great variations in temperature between summer and winter. The mean annual temperature is 47.4° F., and the extremes recorded during the past decade are —40° and 110°, showing an extreme range of 150°. The average annual rainfall is 30.11 inches, more than two-thirds of which usually falls during the six crop months, April to October. These copious but not excessive rains, coinciding with continued high temperature during the summer months, are, next to the rich soil, the chief cause of Iowa's agricultural prosperity.

Practically the whole of Iowa is arable land. The soil may be divided into three distinct kinds, alluvial soil, glacial drift, and loess. The alluvial soil consists of recent deposits on the bottom

AREA AND POPULATION OF IOWA BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Adair	C 3	Greenfield	576	14,534	16,192
Adams	C 4	Corning	432	12,292	13,601
Allamakee	F 1	Waukon	615	17,907	18,711
Appanoose	E 4	Centerville.	500	18,961	25,927
Audubon	B 3	Audubon	432	12,412	13,626
Benton	E 3	Vinton	720	24,178	25,177
Blackhawk	E 2	Waterloo	576	24,219	32,399
Boone	C 3	Boone	576	23,772	28,200
Bremer	E 2	Waverley	432	14,630	16,305
Buchanan	F 2	Independence	576	18.997	21,427
Buena Vista	B 2	Storm Lake	576	13,548	16,975
Butler	E 2	Allison	576	15,463	17,955
Calhoun	C 2	Rockwell City	576	13.107	18.569
Carroll	C 3	Carroll	576	18.828	20,319
Case	B 3	Atlantic	576	19,645	21,274
Cedar	F 3	Tipton	576	18,253	19,371
Cerro Gordo	D 1	Mason City	576	14.864	20,672
Cherokee	B 2	Cherokee	576	15,659	16,570
Chickasaw	E 1	New Hampton.	504	15,019	17,037
Clarke	D 4	Osceola	432	11,332	12,440
Clay	B 1	Spencer	576	9,309	13,401
Clayton	F 2	Elkader	745	26,733	27,750
Clinton	G 3	Clinton	680	41,199	43,832
Crawford	B 2	Denison	720	18,894	21,685
Dallas	C 3	Adel	576	20,479	23,058
Davis	E 4	Bloomfield	500	15,258	15,620
Decatur	D 4	Leon	534	15,643	18,115
Delaware	F 2	Manchester	576	17,349	19,185
Des Moines	F 4	Burlington	400	35,324	35,989
Dickinson	B 1	Spirit Lake	408	4,328	7,995
Dubuque	F 2	Dubuque	604	49,848	56,403
Emmet	C 1	Estherville	408	4,274	9,936
Fayette	F 2	West Union	720	23,141	29,845
Floyd	D 1	Charles City	504	15,424	17,754
Franklin	D 2	Hampton	576	12,871	14,996
Fremont	B 4	Sidney	514	16,842	18,546
Greene	C 2	Jefferson	570	15,797	17,820
Grundy	E 2	Grundy Center	504	13,215	13,757
Guthrie	C 3	Guthrie Center	576	17,380	18,729
Hamilton	D 2	Webster City	576	15,319	19,514
Hancock	D 1	Carthage	576	7,621	13,752
Hardin	D 2	Eldora	576	19,003	22,794
Harrison	B 3	Logan	684	21,356	25,597
Henry	F 4	Mount Pleasant	432	18,895	20,022
Howard	E 1	Cresco	460	11,182	14,512
Humboldt	C 2	Dakotah	432	9.836	12,667
Ida	B 2	Idagrove	432	10,705	12,327
Iowa	E 3	Marengo	576	18,270	19,544


96
95
94
M I N N E S
Luverne
Worthington
Jackson
Fairmont
Blue Earth City
D A K O T A
N E B R A S K A
M I S S O
Canton
Granite
Lester
Rock Rapids
Little Rock
Ocheyedan
Sibley
Lake Park
Spirit Lake
Superior
Estherville
Iowa Lake
Ledyard
Bancroft
Norman
L Y O N
O S C E O L A
D I C K I N S O N
E M M E T
K O S S U T H
W I N N E B A G O
Alvord
Beloit
Doon
George
Ashton
Gopher
Milford
Wallingford
Swan L.
Swea
Buffalo Centre
Forest City
Perkins
Boyden
Sanborn
Sheldon
Hartley
Everly
Graettinger
Burt
Crystal Lake
Rock Valley
S I O U X
Sioux Center
O'B R I E N
Primghar
Spencer
C L A Y
P A L O   A L T O
Ruthven
Emmetsburg
Whittemore
Algona
Wesley
H A N C O C K
Garner
Concord
Mason
Clear Lake
C E R R
Calliope
Hawarden
Orange City
Alton
Maurice
Hosper
Gaza
Paulina
Sutherland
Calumet
Greenville
Peterson
Gillett
Herdland
Ayrshire
Mallard
Irvington
Luverne
Corwith
Kanawha
Goodell
Big Sioux R.
Akron
Westfield
Seney
Oyens
Le Mars
Remsen
Marcus
Meriden
Larrabee
C H E R O K E E
Cherokee
Aurelia
West Scott
B U E N A   V I S T A
Sioux Rapids
Laurens
P O C A H O N T A S
Pocahontas
Rolfe
Gilmore
Bode
Livermore
Renwick
H U M B O L D T
Humboldt
Dakota
Rutland
Bruce
Belmond
Clarion
W R I G H T
Rowan
Eagle Gr.
Dows
P L Y M O U T H
Merrill
Neptune
Racine
Alta
Storm Lake
Newell
Shirley
Hinton
James
Kingsley
Quimby
Washta
Blaine
Fonda
Addison
Thor
Badger
Vincent
Woodstock
Sioux City
Moville
Correctionville
Holstein
Galva
Schaller
Early
Pomeroy
Manson
Twin Lakes
Ft. Dodge
Blairsburg
Webster City
Williams
Sergeant Bluffs
Glen Ellen
Anthon
W O O D B U R Y
I D A
S A C
Sac City
C A L H O U N
Rockwell City
W E B S T E R
Callender
Lehigh
H A M I L T O N
Border Plains
Kamrar
Ellsworth
Jewell
Stratford
Randall
Salix
Sloan
German City
Oto
Smithland
Battle Creek
Idagrove
Arthur
Odebolt
Wall Lake
Grant City
Lohrville
Lake City
Gowrie
Dayton
Danbury
Carnarvon
Missouri
Badger L.
Whiting
Ticonic
Mapleton
Kiron
Breda
Browning
Churdan
Paton
Pilot Mound
Mineral Ridge
Story City
Roland
M O N O N A
Ute
Deloit
Charter Oak
Vail
Arcadia
Westside
Maple River
Carroll
Farlin
Boonesboro
Ogden
Boone
Onawa
Turin
C R A W F O R D
Denison
C A R R O L L
Glidden
G R E E N E
Scranton City
Jefferson
Grand Junc.
B O O N E
Moingona
Ames
Nevada
S T O R Y
Soldier
Blencoe
Lydia
Manilla
Dow City
Moorhead
Templeton
Dedham
Manning
Coon Rapids
Cooper
Rippey
Berkley
Angus
Madrid
Cambridge
Sheldahl
Elkhart
Polk City Jc.
Polk
Little Sioux
River Sioux
Dunlap
Manteno
Defiance
Gray
Bayard
Herndon
Woodward
Perry
Minburn
Earling
Kirkman
Ross
Wichita
Magnolia
Woodbine
Panama
Audubon
A U D U B O N
G U T H R I E
Guthrie Center
Panora
D A L L A S
P O L K
Mondamin
H A R R I S O N
Logan
Modale
California
Missouri Valley
Union-burgh
S H E L B Y
Harlan
Portsmouth
Hamlin
Exira
North Branch
Bear Grove
Jobes
Adel
Redfield
Dallas Centre
Waukee
Valley Jc.
Boonesville
DES MOINES
Blair
Shelby
Elk Horn
Brayton
Menlo
Stuart
Dexter
Casey
Adair
Earlham
De Soto
Van Meter
Hartford
Honey Cr.
Loveland
Pigeon Cr.
Harlan Jc.
Minden
Avoca
Walnut
Marne
Anita
Neola
Crescent
Weston
Hancock
Atlantic
Wiota
Canby
North
M A D I S O N
Spring Hill
Indianola
P O T T A W A T T A M I E
Oakland
C A S S
A D A I R
Winterset
W A R R E N
Omaha
Council Bluffs
Carson
Macedonia
Lewis
Griswold
Cumberland
Greenfield
Fontanelle
Hebron
Peru
St. Charles
Milo
Platte
Reno
Fisk
Orient
Macksburgh
New Virginia
Elliott
Grant
Mt. Etna
Carbon
Carl
Nevinville
Spaulding
Creston
Jamison
Liberty
Norwood
Osceola
Cleveland
Pacific City
Silver City
M I L L S
Emerson
Sciola
Quincy
Cromwell
U N I O N
Thayer
Murray
C L A R K E
Woodburn
Plattsmouth
Glenwood
Malvern
M O N T G O M E R Y
A D A M S
Prescott
Afton
Afton Jc.
Red Oak
Stanton
Brooks
Corning
Kent
Hopeville
Leslie
Smyrna
Derby
Pacific Jc.
White Cloud
Coburgh
Villisca
E. Nodaway
Arispe
Tabor
Imogene
Randolph
Hepburn
Lenox
Tingley
Van Wert
Humeston
Essex
Clearfield
Diagonal
Westerville
Woodland
Garden Grove
Corydon
Percival
F R E M O N T
Shenandoah
Hawleyville
Gravity
Beaconsfield
D E C A T U R
Nebraska City Jc.
Nebraska City
Sidney
P A G E
Clarinda
T A Y L O R
New Market
Conway
R I N G G O L D
Decatur
Leon
W A Y
Farragut
Bedford
Mount Ayr
Kellerton
Davis City
Big Spring
Riverton
Coin
Shambaugh
College Spgs.
Siam
Platteville
Delphos
Lamoni
Clio
Hamburg
High Cr.
Blanchard
Braddyville
Redding
Bethany
Pleasanton
Lineville
State Line
Rockport
Grant City
Princeton
Brownville
Nemaha City
Maryville
Nodaway
Bethany
Missouri R.
42
41
96
95
Longitude
94
West



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AREA AND POPULATION OF IOWA BY COUNTIES.

(Continued.)

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Jackson	G 2	Maquoketa	619	22,771	23,615
Jasper	D 3	Newton	720	24,943	26,976
Jefferson	E 3	Fairfield	432	15,184	17,437
Johnson	F 3	Iowa City	578	23,082	24,817
Jones	F 2	Anamosa	576	20,233	21,954
Keokuk	E 3	Sigourney	576	23,862	24,979
Kossuth	C 1	Algona	984	13,120	22,720
Lee	F 4	Fort Madison	490	37,715	39,719
Linn	F 2	Marion	720	45,303	55,392
Louisa	F 3	Wapello	396	11,873	13,516
Lucas	D 4	Chariton	432	14,563	16.126
Lyon	A 1	Rock Rapids	600	8,680	13,165
Madison	C 3	Winterset	576	15,977	17,710
Mahaska	E 3	Oskaloosa	576	28,805	34,273
Marion	D 3	Knoxville	576	23,058	24,159
Marshall	D 2	Marshalltown	576	25,842	29,991
Mills	B 3	Glenwood	445	14,548	16,764
Mitchell	E 1	Osage	480	13,299	14,916
Monona	A 2	Onawa	432	14,515	17,980
Monroe	E 4	Albia	432	13,666	17,985
Montgomery	B 4	Redoak	432	15,848	17,803
Muscatine	F 3	Muscatine	435	24,504	28,242
O'Brien	B 1	Primghar	576	13,060	16,985
Osceola	B 1	Sibley	408	5,574	8,725
Page	B 4	Clarinda	528	21,341	24.187
Palo Alto	C 1	Emmetsburg	576	9,318	14,354
Plymouth	A 2	Lemars	820	19,568	22,209
Pocahontas	C 2	Pocahontas	576	9,553	15,339
Polk	D 3	Des Moines	576	65,410	82,624
Pottawattamie	B 3	Council Bluffs	876	47,430	54,336
Poweshiek	E 3	Montezuma	576	18,394	19,414
Ringgold	C 4	Mountayr	545	13,556	15,325
Sac	B 2	Sac City	576	14.522	17,639
Scott	C 3	Davenport	447	43,164	51,558
Shelby	B 3	Harlan	576	17,611	17,932
Sioux	A 1	Orange City	768	18,370	23,337
Story	D 2	Nevada	576	18,127	23,159
Tama	E 2	Toledo	720	21,651	24,585
Taylor	C 4	Bedford	540	16,384	18,784
Union	C 3	Creston	432	16,900	19,928
Van Buren	E 4	Keosauqua	502	16,253	17,354
Wapello	E 3	Ottumwa	432	30,426	35,426
Warren	D 3	Indianola	576	18,269	20,376
Washington	F 3	Washington	576	18,468	20,718
Wayne	D 4	Corydon	528	15,670	17,491
Webster	C 2	Fort Dodge	720	21,582	31,757
Winnebago	D 1	Forest City	408	7,325	12,725
Winneshiek	F 1	Decorah	696	22,528	23,731
Woodbury	A 2	Sioux City	864	55,632	54,610
Worth	D 1	Northwood	408	9,247	10,887
Wright	D 2	Clarion	576	12,057	18,227

lands of the principal rivers; the principal tract is the Missouri Bottoms, 150 miles long, and from 5 to 20 miles wide. This is, of course, the richest soil of the State, but is, nevertheless, rivaled by the drift soil. The latter consists of a fine loamy mixture of clay and sand, with a little gravel. It is of almost inexhaustible richness, and scarcely needs fertilizing. It covers by far the greater part of the State. The loess is a fine yellowish sand highly charged with carbonate of lime. It is found in various parts of the State, generally along the margins of the various drift areas, and is generally considered to be of glacial origin.

For flora and fauna, see UNITED STATES.

GEOLOGY AND MINERAL RESOURCES. Owing to the heavy covering of drift, a thorough geological survey of Iowa is attended with difficulties. Nevertheless our knowledge of the rock formations is fairly complete. In more than three-fourths of the State the surface consists of Paleozoic rocks appearing in parallel belts running northwest to southeast. Beginning at the northeastern corner, there is a narrow belt of Cambrian formation consisting of Potsdam sandstone; then follow the Silurian, Devonian, and the Lower and Upper Carboniferous formations, the latter occupying the southwest corner of the State. The northwestern part is covered by extensive Cretaceous beds deposited across and over the belts of the older strata. Finally, in the extreme northwest corner there are outcroppings of metamorphosed rock of the Algonkian period, known as Sioux quartzite, the oldest formation in the State. Over the entire surface, with the exception of a small driftless area in the northeastern corner, is a deposit of glacial drift from a few inches to several hundred feet in thickness. It consists mainly of fine rock fragments with but few boulders and pebbles. The limits of the various drift sheets, the older in the south and the later in the north, are clearly defined, although there are no typical moraines.

The most valuable of Iowa's mineral resources are the extensive bituminous coal beds found in the southeastern quarter of the State. Lead and zinc ores have been mined in considerable quantities in the Galena limestone of the Lower Silurian formation of the northeast. Extensive deposits of gypsum are also found, and various other minerals occur in smaller quantities, limonite iron ore being the only metallic deposit besides lead which seems at all promising. The limestones of the Devonian and Upper Silurian formations furnish an inexhaustible supply of building-stone of the finest quality.

MINING. Bituminous coal is extensively mined in the eastern part of the State. An average of over 10,000 men are employed annually in the industry. In the early part of the decade 1890-1900, the production averaged a little in excess of 4,000,000 tons annually, but in the latter years of that period it exceeded 5,000,000 tons annually. The value of the product at the mine in 1900 was $6,968,866. Only one State west of the Mississippi River, Colorado, exceeds Iowa in the value of its coal output. The coal-fields are of great importance, not only to the State, but to the northwest region. Increasing quantities of limestone are quarried in the State, the value of the annual output having nearly doubled in the decade 1890-1900, being estimated in the latter year at $800,000. Clays suitable for brick manufacture are abundant and are extensively utilized. Small quantities of zinc and gypsum are mined.

AGRICULTURE. Iowa is preëminently an agricultural State, and in the census year 1900 exceeded every other State in the value of farm products. Of its total land area, 97.4 per cent. is included in farms, and of this, 86.5 per cent. is improved. In neither of these respects was Iowa exceeded in 1900. The average size of farms decreased decidedly between 1850 and 1880, but increased again during the two succeeding decades, the average number of acres per farm in 1900 being 151.2. In the northwestern part of the State the average was much in excess of this figure, exceeding 200 acres in a few counties. There are indications of a considerable decrease in the number of farm laborers as compared with the number of owners and tenants since the census year 1880. For the succeeding two decades the number of farms operated by tenants increased 80.5 per cent., as compared with an increase of only 5.5 per cent. for the farms operated by owners. The increase in the number of rented farms was wholly on the part of those rented according to the cash system, the number of these being five times greater in 1900 than in 1880, and constituting 19.5 per cent. of the total number of farms, while the farms rented on shares were but 15.4 per cent. of the total. The soil is well drained, producing abundantly without the aid of artificial fertilizers. The greater certainty of the rainfall exempts the State from crop failures such as occur in the States farther west. There are only two or three States which rival Iowa in the production of cereals. Nearly one-half of its entire land surface is devoted to these products. The State is noted especially for its corn crops, the acreage for which amounts to over one-fourth of its total area, and contributes about one-half of the total value for all crops. Every decade in the State's history shows an increase in the acreage and production of this crop, the largest gain being in the decade 1870-80. The crop is grown most extensively in the central and southwestern counties. Oats rank next in importance, with about one-half the acreage and one-third the value of corn. The State usually takes first place in the production of this cereal. Like corn, each census has shown a large gain over the preceding. The crop is grown most extensively in the northern part of the State. The attention given to wheat is in marked contrast with that given to corn and oats. In 1880 it was five times as great as in 1890. There has since been a revival in the cultivation of wheat, the increase during the decade 1890-1900 being nearly threefold. It is raised most extensively in the northern and northwestern counties. The State ranks second in the production of barley, this crop also being most extensively grown in the northern part. Less important cereals are rye and buckwheat. Flaxseed is also grown. The large stock interests of the State make heavy demands upon hay and forage crops, and the State ranks second in the acreage devoted to these products. The area devoted to them continued to increase rapidly until 1890, but in the following decade it fell off 15.4 per cent. The soil is well adapted to vegetables, and the State ranks second in the production of Irish potatoes. The fruit industry is rapidly developing, the total number of trees for all fruits having more than doubled during the decade 1890-1900. Over 71 per cent. of the total are apple-trees. Grapes and small fruits are successfully grown.

STOCK-RAISING. Stock-raising is naturally associated with the raising of corn, oats, and forage crops. Compared with other States, stock-raising holds a still higher rank than the raising of crops. Texas alone rivals Iowa in the value of live stock, and is the only State which exceeds it in the number of cattle. Iowa is far in advance of all others in the number of swine, and leads also in the number of horses. A very low rank, however, is taken in the number of mules and sheep. The number of neat cattle, horses, and swine has increased for every decade between 1850 and 1900. The decrease in the number of dairy cows, as shown by the census for the decade 1890-1900, is probably due to the change in the method of making the count, and is therefore more apparent than real. Much attention is given to the improvement of the breed of stock, and the effect of this is shown in the high average of the per head value. The number of dairy cows being exceeded only in New York, the value of the dairy product is naturally great, $18,819,000 being realized from the sales of these products for the year 1899, of which amount $12,275,000 represented the receipts from milk. The value of poultry and eggs was even greater, being $19,508,000. The following tables show the number of acres devoted to the leading crops and the number of domestic animals for the census years 1890 and 1900:

YEAR	Corn, acres	Oats, acres	Wheat, acres	Barley, acres	Flax, acres	Hay and forage, acres	Potatoes, acres
1900	9,804,076	4,695,391	1,689,705	627,851	126,453	4,644,378	175,888
1890	7,585,522	3,752,141	585,548	518,729	230,085	5,490,027	?

YEAR	Dairy cows	Other neat cattle	Horses	Mules and asses	Sheep	Swine
1900	1,423,648	3,943,982	1,392,573	57,579	657,868	9,723,791
1890	1,498,418	3,397,182	1,312,079	41,648	547,394	8,266,779

MANUFACTURES. Iowa's prosperity is based upon agriculture and not manufacturing. Notwithstanding the excellence of the transportation facilities and the abundant coal-supply, the State depends upon the East in a large measure for its manufactured supplies, and a large portion of the farm products of the State are shipped to outside points to be manufactured. In the decade 1880-90 the number of wage-earners engaged in manufacturing increased 79.9 per cent., while in the following decade the increase was 14.7 per cent. The wage-earners in 1900 numbered 58,500, or 2.6 per cent. of the population. The total value of products, including custom work and repairing, was $164,617,800. Of this, $22,236,700 represented the products of hand trades. The remainder represents manufactures proper, which include a great variety of industries. The table above covers the eleven leading industries for the census years 1890 and 1900. It will be seen that considerably over half of the total product of these industries is ob-

COMPARATIVE SUMMARY OF ELEVEN LEADING INDUSTRIES

INDUSTRIES	Year	Number of establishments	Wage-earners, average number	Value of products, including custom work and repairing
Total for selected industries for State	1900	3,821	27,108	$95,924,681
	1890	2,613	28,767	79,751,171
Increase 1890 to 1900	......	1,208	1,659	$16,173,510
Per cent. of increase	......	46.2	5.8	20.3
Per cent. of total of all industries in State	1900	25.8	46.3	58.3
	1890	35.1	56.4	63.8
Slaughtering and meat-packing	1900	27	2,887	25,695,044
	1890	29	2,575	23,425,576
Cheese, butter, and condensed milk, factory product	1900	907	1,133	15,846,077
	1890	497	2,355	10,545,182
Flouring and grist-mill products	1900	702	1,285	13,823,083
	1890	441	1,248	11,833,737
Food preparations	1900	16	609	3,604,031
	1890	8	147	900,811
Lumber and timber products	1900	264	2,793	8,677,058
	1890	143	6,819	12,056,302
Lumber, planing-mill products, including sash, doors, and blinds	1900	65	2,372	5,295,546
	1890	46	1,983	3,588,856
Carriages and wagons	1900	211	1,692	3,931,067
	1890	294	1,602	3,168,545
Cars and general shop construction and repairs by steam railroad companies	1900	58	5,497	6,221,378
	1890	41	3,812	4,473,089
Printing and publishing: Total	1900	1,028	4,248	6,145,563
	1890	699	3,296	4,551,548
Foundry and machine-shop products	1900	190	2,372	4,460,914
	1890	126	2,142	3,432,360
Clay products: Total	1900	356	2,220	2,224,920
	1890	289	2,788	1,775,165

tained from the manufacture of food products, and is the natural outgrowth of the great agricultural importance of the State. Over a fourth of the product, or 15.6 per cent. of the total value of the products, is represented by the slaughtering and meat-packing industry. This, however, falls much below the value of the same products in a number of the other Mississippi Valley States. The factory products of cheese, butter, and condensed milk rank next in importance. In this industry the State is surpassed by only two others. During the decade 1890-1900 the industry increased 50.3 per cent. Flouring and grist mill products are next in rank, but the value of these is much less than it is in most of the other North Central States. The manufacturing of food preparations is still of minor importance, but showed a very significant gain during the decade.

Another important group of manufactures depends upon the timber resources of the State for its raw materials. The forests, largely limited to the river-courses in the eastern part of the State, have now become greatly reduced. The larger and finer trees throughout the forest area have generally been removed. There has been a resulting decrease in the value of the lumber and timber products. Nevertheless, the products of the planing-mills and of the carriage and wagon factories have recently increased in value.

The extensive development of railroads in the State gives occasion for the construction of cars and for repair-shop works, and this industry employs more wage-earners than does any other branch of manufacturing. Printing and publishing, and the making of foundry and machine-shop products, are important industries. The manufacture of pearl buttons has developed during the decade into a thriving industry. The material out of which the buttons are made is the shell of the fresh-water mussel. None of the foregoing industries is centralized at any one place. The lumber industry is greatest along the Mississippi River, but the industries in general are well distributed throughout the State. Sioux City, Davenport, Dubuque, and Des Moines are the leading centres.

Transportation. Iowa is admirably provided with transportation facilities. Water transportation is afforded by the Mississippi River on the east. Owing to the State's situation, a large number of the most important railroad lines of the country pass through it. Des Moines is the centre of a large number of lines, and every section of the State is amply provided. It is interesting to note that in the western part most of the railroads follow the course of some river, so that all the larger tributaries to the Missouri River are paralleled by a railroad, thus giving them a northeast and southwest direction. The first railroad was constructed in Scott County, in 1854. In 1860 there were 655 miles of railroad; in 1890, 8416; and in 1900, 9391 miles. The decade of greatest increase was that between the years 1880 and 1890. There are 16.56 miles of line to every 100 square miles of territory, and 41.15 miles to every 10,000 inhabitants. Only three States exceed Iowa in actual mileage, and only one of these—Texas—is west of the Mississippi River. A railroad commission fixes rates, and its schedules are to be deemed reasonable until disproved.

Banking. Iowa is remarkable in that it has a larger number of banks and banking houses than has any other State in the Union. In 1902 it had 230 national banks, with loans amounting to $74,032,000; cash, etc., $5,533,000; capital, $15,485,000; and deposits, $66,585,000. The 508 State banks had in the same year a capital of $18,131,400, and a surplus of $2,312,061. The private banks numbered 667 and had a capital of $12,612,339 and a surplus of $1,754,489.

Finance. According to the Constitution, the credit of the State cannot be loaned to any individual, association, or corporation, nor can the State become responsible for the debts or liabilities of any of these. Unless for war purposes, the State cannot incur an indebtedness greater than $250,000. No county or other political or municipal corporation can incur an indebtedness exceeding 5 per cent. of the value of its taxable property. In 1900 the State indebtedness amounted to only $10,936. For the year ending June, 1900, the receipts amounted to $2,592,496; the disbursements to $2,056,027. Property is assessed at its full value, one-fourth of which constitutes its taxable value.

Government. Iowa has its second Constitution, the present one being adopted in a convention, and in turn by a general election in 1857. Each tenth year the question "Shall there be a convention to revise the Constitution and amend the same?" is voted upon at a general election. and if a majority of the qualified electors approve the proposition, a convention must be called by the General Assembly. A proposed amendment must receive a majority vote of the members elected to each of the two Houses at two consecutively chosen Legislatures and then be approved by a majority of the State electors at a popular election. Male citizens who have resided in the State six months, and in the county sixty days, and who are accounted of sane mind and have not been convicted of any infamous crime, are allowed to vote.

Legislative. The capital is Des Moines. The day on which elections occur is the Tuesday next after the first Monday in November. The Legislature consists of a Senate of not exceeding fifty members, elected for four years, half of them biennially, and a House of not exceeding one hundred members, elected biennially. Each member receives a compensation fixed by law. The sessions are biennial, occurring in the even years. Senators must be twenty-five years of age; Representatives, twenty-one years; and the Governor and Lieutenant-Governor, thirty years. Bills may originate in either House, and every bill requires the assent of a majority of all the members elected to each branch in order to become a law. A majority of two-thirds of the members of each House overcomes the Governor's veto. All impeachments must be made by the House and tried by the Senate.

Executive. The Governor, Lieutenant-Governor, Secretary of State, Auditor, Attorney-General, and Treasurer, are elected for terms of two years. The Lieutenant-Governor, president *pro tempore* of the Senate, and the Speaker of the House, are in the line of succession to the Governorship, in case of vacancy in that office. The Governor has the usual pardoning power, under regulations, and may convoke extraordinary sessions of the Legislature.

Judicial. The Supreme Court consists of a chief judge and five associate justices. The State is divided by the Legislature into districts, in each of which a district judge is elected for a term of four years. Other courts are established by the Legislature. Each county elects a county attorney, who serves for two years.

The property rights of husbands and wives are equal, each upon the death of the other inheriting one-third in value of his or of her real estate, while neither is liable for the separate debts of the other. The contracts made by the wife in her own name are enforced by or against her precisely as if she were unmarried. A married woman may sue or be sued without the husband being joined in the action. Women are by law eligible to all offices connected with the public schools. The legal rate of interest is 6 per cent., but 8 per cent. is allowed by contract. The State sends eleven members to the National House of Representatives.

Militia. In 1900 the total number of males of militia age was 475,760. In 1899 the organized militia, including men and officers, numbered 1873.

Population. The population of Iowa by decades is as follows: in 1840, 43,112; in 1850, 192,214; in 1860, 674,913; in 1870, 1,194,020; in 1880, 1,624,615; in 1890, 1,911,896; in 1900, 2,231,853. From twenty-seventh in rank in 1850, it advanced to tenth in 1880, which position it has since held. The per cent. of increase for the last decade of the century was 16.7, as compared with 20.7 for the United States. The native American settlers in Iowa came almost wholly from the older Northern States. The State was being settled during the period of heavy German and Scandinavian immigration, and a large number of these immigrants, particularly the former, secured homes; and the two combined constitute nearly two-thirds of the foreign-born population, which numbered, in 1900, 305,920. The negro population numbered 12,693. In the total population the males are about 81,000 in excess of the females. There were, at the last census, 40.2 people to the square mile. There is no large centre of population in Iowa, and the percentage of the urban population is resultingly small as compared with most of the North Central States. In 1900 the 33 towns having a population exceeding 4000 each, contained 20.5 of the total population.

In 1900 the following cities exceeded 25,000 in population: Des Moines, 62,139; Dubuque, 36,297; Davenport, 35,254; Sioux City, 33,111; Council Bluffs, 25,802; Cedar Rapids, 25,656.

Religion. While the Catholics have the largest number of members of any Church, the membership of the Methodist Church, together with its adherents, is much stronger, and is almost twice as great as that of any other Protestant denomination. Among a large number of other churches represented, the largest in their order are: Lutherans, Presbyterians, Baptists, Disciples of Christ, and Congregationalists.

Charitable and Penal. There is a Board of Control of State Institutions appointed by the Governor and Senate. The board is vested with full power to manage, control, and govern the charitable and penal institutions of the State and to fix the salaries of officers and employees other than the chief executive officers. The following table shows the situation of the various institutions, the number of inmates on June 30, 1899, and the total and per capita expenditure of each for the year ending with that date:

INSTITUTIONS	No. of Inmates	Total expenditure	Per capita expenditure
Soldiers' Orphans' Home, Davenport	445	$47,599	$102.96
Soldiers' Home, Marshalltown	665	75,428	139.40
College for Blind, Vinton	228	25,692	164.10
Industrial Home for Blind, Knoxville	50	8,348	
School for the Deaf, Council Bluffs	265	43,321	157.18
Institution for Feeble-Minded Children, Glenwood	815	115,222	152.01
Industrial School for Boys, Eldora	473	50,668	104.15
Industrial School for Girls, Mitchellville	189	19,497	110.40
Hospital for Insane, Mount Pleasant	896	119,885	139.57
Hospital for Insane, Independence	1,050	137,563	136.60
Hospital for Insane, Clarinda	851	120,922	148.00
State Penitentiary, Fort Madison	524	81,493	156.72
State Penitentiary, Anamosa	529	120,849	207.28
	6,980	$966,487	

The expenditure for the year given is considerably reduced from that of the preceding, although the care of the inmates improved decidedly during the same period. Under the new board, supplies for the various institutions are purchased at wholesale prices and under competitive bids. The graded system has been introduced in the penitentiaries, and the Anamosa prison has adopted the Bertillon system of measurements. On June 30, 1899, the various counties supported 621 insane patients in county asylums and 659 others at poorhouses. More than twenty counties have erected asylums for the care of the insane. There are also four private asylums, containing about 400 insane patients.

Education. According to the census of 1900, no State has a lower per cent. of illiterates than Iowa, the figure being only 2.3 per cent. of the population over ten years of age, as compared with 10.7 for the whole country. This showing is noteworthy in view of the fact that there is no compulsory school-attendance law. In 1899 76.2 of the population between five and twenty-one years were enrolled in public schools, of whom 65.6 attended 'regularly.' The average length of the school term in 1900 was 158 days, which was lower than it had been before for more than a decade. The State has had some very great administrative problems to contend with, notably the difficulty occasioned by too great multiplication of school districts, together with a decreasing rural population and the lack of gradation common in the country schools. In 1899, 34 per cent. of the independent schools and 54 per cent. of the sub-district schools had an average daily attendance of less than fifteen. In a few places the difficulty is being solved by the method of consolidation and transportation. In the above year 12,616 schools in the State were ungraded, as against 5561 that were graded. The county system of superintendents is at the disadvantage of being made a political matter, and the popularly elected superintendents serve for only the brief term of two years. With one exception, Iowa pays the lowest average monthly salary to both male and female teachers of any State west of the Mississippi. Before 1900 the State provision for normal training was inadequate, and but a comparatively small per cent. of the teachers received special training. In 1900 a law was passed establishing a new State normal college, to be situated at Cedar Falls. In 1900 the female teachers numbered 22,839, and the males 5855. The State board of examiners issues, upon examination, life and five-year licenses valid throughout the State, and the county superintendents issue certificates for different grades, each good for one or two years in the county in which it is issued.

High schools are maintained in nearly all the cities, towns, and villages, and in a few counties there are township high schools, but the high school courses are characterized by great lack of uniformity, there being no localized or well-established standard to which they must conform. In 1900 the total wages received by teachers and superintendents amounted to $5,417,663, and the total cost of education to the State was $7,978,060, or $15.37 for each child enrolled. The total school fund in 1899 was $4,724,804. The State maintains a university (q.v.) at Iowa City, and a State agricultural college at Ames. There are also a large number of denominational institutions; namely, Upper Iowa University at Fayette (Methodist Episcopal); Tabor College at Tabor (Congregational); German College at Mount Pleasant (Methodist Episcopal); Iowa Wesleyan University at Mount Pleasant (Methodist Episcopal); Cornell College at Mount Vernon (Methodist Episcopal); Central University of Iowa at Pella (Baptist); Amity College at College Springs (non-sectarian); Des Moines College at Des Moines (Baptist); Iowa College at Grinnell (Congregationalist); Penn College at Oskaloosa (Friends); Simpson College at Indianola (Methodist); Norwegian Lutheran College at Decorah (Lutheran); Drake University at Des Moines (Church of Christ); Morningside College at Sioux City (Methodist Episcopal); Coe College at Cedar Rapids (Presbyterian); Parsons College at Fairfield (Presbyterian).

HISTORY. The aboriginal inhabitants of the State were the Indian tribes of Iowa (q.v.) and Illinois (q.v.), who in the course of time were driven from their homes by the Sacs and Foxes. Marquette and Joliet, in 1673, and Hennepin, in 1680, touched on the borders of the State. In 1788 Julien Dubuque, a Frenchman from Canada, obtained from the Indians the grant of a large tract of land, including the site of the city now bearing his name, and the rich mineral country surrounding it. He built a fort there, carried on the mining of lead, and traded with the Indians, but on his death, in 1810, the settlement was abandoned. In 1803 the region passed to the United States as a part of the Louisiana cession, and Indian titles to the land were extinguished by treaties in the years 1804, 1832, and subsequently. It formed, in turn, a part of the Territories of Louisiana (organized in 1804), Missouri, Michigan, and Wisconsin. On June 12, 1838, it was organized as the Iowa Territory. In 1832 a number of emigrants settled on the site of Fort Madison, which had been erected by the United States Government in 1808 and abandoned five years later. About the same time a settlement was made in the neighborhood of Burlington, and in 1833 Dubuque was founded. Six years later the Government was removed to Iowa City, and in 1844 a State constitution was framed and admission to the Union sought for. After some delay, caused by the action of Congress in restricting greatly the boundaries of the new State, and after the rejection of two constitutions, the State was admitted on December 28, 1846. Immigration into the State was rapid, and continued in spite of a bloody massacre of whites by Sioux Indians at Spirit Lake in March, 1857. In the same year the original Constitution of 1846 was revised and Des Moines was made the capital. In the Civil War, Iowa, whose fundamental law prohibited slavery, took a zealous part. The two most important questions of public moment since 1870 have been railway legislation and prohibition. The development of the State was greatly accelerated by the building of railroads, of which there were, in 1900, nearly 10,000 miles, but with the rise of powerful railway corporations, there ensued a continuous conflict between the Legislature and the companies in regard to the taxation of railway property and the regulation of rates. In 1872 an act taxing railway property was passed, and in 1873 a powerful agitation stirred up by the Patrons of Husbandry (see GRANGE) against the extortionate rates imposed by the companies led to the creation of a board of railroad commissioners for the purpose of determining a maximum rate and preventing discrimination. Radical action on the part of the commissioners caused repeated appeals to the courts, and though many concessions were wrung from the companies, the advantage in general remained with them. A Prohibition amendment adopted in 1882 was promptly declared unconstitutional by the courts. A new law went into effect in 1884, and for some years proved fairly adequate. A very large part of the population, however, was opposed to sumptuary legislation, and in 1890, under the protection of the interstate commerce laws, a successful attempt was made to evade the anti-liquor regulations by the importation of alcoholic products from other States. In 1894 the courts declared the prohibitory laws unconstitutional. From 1846 to 1854 the State was Democratic both in National and State politics. Since 1854 its vote in national elections has always been cast for the Republican candidate. The State government, as a whole, has always been in the hands of the Republicans, and only in 1889 and 1891, years of stormy railway and liquor legislation, was a Democratic Governor elected.

The Governors of Iowa since its organization as a Territory have been as follows:

TERRITORIAL

Robert Lucas	1838–41
John Chambers	1841–46
James Clark	1846

STATE

Ansel Briggs	Democrat	1846–50
Stephen Hempstead	"	1850–54
James Wilson Grimes	Whig and Free-Soil Democrat	1854–58
Ralph P. Lowe	Republican	1858–60
Samuel J. Kirkwood	"	1860–64
William M. Stone	"	1864–68
Samuel Merrill	"	1868–72

Cyrus C. Carpenter	Republican	1872–76
Samuel J. Kirkwood	"	1876–77
Joshua G. Newbold	"	1877–78
John H. Gear	"	1878–82
Buren R. Sherman	"	1882–86
William Larrabee	"	1886–90
Horace Boies	Democrat	1890–94
Frank Darr Jackson	Republican	1894–96
Francis Marion Drake	"	1896–98
Leslie Mortimer Shaw	"	1898–1902
Albert B. Cummins	"	1902—

BIBLIOGRAPHY. Monette, *History and Discovery of the Mississippi Valley* (New York, 1846); Hyatt, *Manufacturing, Agricultural, and Industrial Resources of Iowa* (Des Moines, 1873); *Iowa Geological Survey Publications* (Des Moines, 1893 et seq.); *State Historical Society Annals* (Iowa City); Shambaugh, *Documentary Material Relating to the History of Iowa* (Iowa City, 1898).

IOWA. A river in the State of Iowa, rising in Hancock County, near the Minnesota line, and flowing southeast into the Mississippi, 35 miles north of Burlington (Map: Iowa, F 3). It is 300 miles long and navigable to Iowa City, 80 miles from its mouth.

IOWA. The Algonquian title of a tribe of American Indians, forming one of the main divisions of the great Siouan linguistic family. At the beginning of the eighteenth century they dwelt in Minnesota, and afterwards farther south in the area which now bears their name. They were called Pahotcha or Pahucha (dusty noses) in their own tongue, Ayanway by Lewis and Clark, and Ajowes by French traders. In 1836 they were moved to the west bank of the Missouri above Wolf River, and in 1861 they ceded to the United States 16,000 acres of land. At present they number 1100, and are living on reservations in Kansas and Oklahoma.

IOWA, STATE UNIVERSITY OF. An educational institution for both sexes in Iowa City, Iowa, organized with an endowment by Congress of two townships of land, to which has been added a permanent annual State appropriation of $125,000, and a tax of one-fifth of a mill for building purposes, making a total annual income of over $402,000, including tuition fees. The institution was opened in 1855 and reorganized in 1860. The buildings are seventeen in number, and with the grounds are valued at about $700,000. The library suffered the loss of 25,000 volumes by a fire in 1897, and in 1902 contained about 63,000 volumes and a large number of pamphlets. The work of the university is organized in a college of liberal arts, colleges of law, medicine, homœopathic medicine, dentistry and pharmacy, a graduate department, the Iowa School of Political and Social Science, and two hospitals. The college of liberal arts confers the degrees of B.A., B.Ph., and B.S. The graduate college confers the degrees of M.A., M.S., Ph.D., civil engineer, and electrical engineer. The college of liberal arts maintains a summer session for teachers and a summer school for library training. The university provides public lectures and extension courses, and is in close touch with the educational institutions of the State through its system of accredited high schools. The attendance in 1902 (excluding duplicates) was 1512. The faculty, instructors, and administrative staff numbered 165. The publications of the university include a *Natural History Bulletin*, a *Law Bulletin*, *University Studies in Psychology*, and *Studies in Sociology*, *Economics*, *Politics*, *Languages*, and *History*. The control of the university is vested in a board of regents, consisting of the Governor of the State, the Superintendent of Public Instruction, and eleven members chosen by the General Assembly of Iowa.

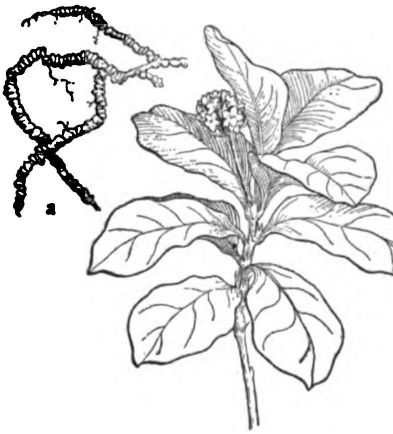
IOWA CITY. A city and the county-seat of Johnson County, Iowa, 54 miles west by north of Davenport, on the Iowa River, and on the Chicago, Rock Island and Pacific Railroad (Map: Iowa, F 3). The State University occupies the grounds and buildings of the former Capitol, and also a handsome collegiate building recently erected by the commonwealth. In Iowa City are the State Historical Society Library, Iowa City Academy, Mercy Hospital, and the medical department and homœopathic hospitals, connected with the university; and among other prominent structures are the county court-house, city hall, and opera house. An appropriation of $60,000 for a post-office building here has been made, and $25,000 has been contributed by Andrew Carnegie for a public library. The industrial establishments comprise meat-packing plants, agricultural-implement works, a large jewelry-factory, flouring-mills, knitting-mills, glove and mitten factories, broom-factories, soap and perfume factories, brick and tile works, a foundry and machine-shops, etc. The government is administered by a mayor, elected every two years, and a unicameral council. Population, in 1890, 7016; in 1900, 7987. Founded in 1839 and incorporated in 1853, Iowa City was from 1839 to 1857 the capital of Iowa Territory and State. It was connected with the East in 1855 by the completion of the Mississippi and Missouri Railroad. Consult: Shambaugh, *Iowa City: A Contribution to the Early History of Iowa* (Iowa City, 1893); and an article, "The Historic Capital of Iowa," in *Magazine of American History*, vol. xxi. (New York, 1888).

IOWA COLLEGE. The oldest collegiate institution in the State of Iowa, founded in 1846 by an association of Congregationalists and Presbyterians at Davenport, and incorporated in the following year. The college was opened in 1848, and in 1859 it was removed to its present situation in Grinnell. The institution includes three departments, the college, the academy, and the school of music, since 1857 open to both sexes. In 1895 the collegiate courses were arranged on the group system, and lead to the degrees of B.A. and B.Ph. The college grounds include a campus of twenty-two acres, a park of four acres, and an athletic field of fourteen acres. There are six college buildings, valued in 1902 at $175,000. In that year the endowment was $360,000, with an income of $47,000. The library contained 30,000 volumes. The faculty numbered 37, and the attendance was 456, including 9 graduate students, 294 students in the college, 103 in the academy, and 87 in the school of music.

IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS. A coeducational State institution at Ames, Iowa, established by act of Legislature in 1858. In 1862 the college came into possession of a grant of public lands bestowed by general act of Congress for the purpose of fostering agricultural and mechanic education. It was formally opened in 1869. It is a college of advanced technology, and organized in divisions of agriculture, engineering, veterinary medicine, and science. The department of agriculture is designed to give a general training for the career of a farmer and, in its longer course, to develop specialists in particular lines of work. A well-stocked farm provides practical work in all the agricultural processes, and the Iowa Experiment Station, in intimate relation to the college work of instruction, gives opportunity for original investigations of agricultural problems. In addition to courses in mechanical, civil, electrical, and mining engineering, the college gives instruction in clay-working and ceramics, and has a department of technology intended to equip students for the manufacturing industries. The division of science supplies foundations in science, language and literature, and economic science. In the instruction of women emphasis is laid on the course in domestic economy. All male students are required to become members of the college battalion. The college domain includes about 840 acres, of which about 120 acres form the campus. The buildings number 17 besides dwelling-houses and buildings for farm stock, machinery, and work, all valued at $575,000. The endowment in 1902 was $683,000, the income $165,000, and the value of all the college property $1,500,000. The library contained 14,000 volumes. Tuition is free to residents of Iowa, students from other States paying an annual fee of $24. Students are admitted on examination or on certificates from accredited schools. The college has of late developed rapidly, and in 1903 had an attendance of 1350 students, and a faculty of 84 members.

IOWA WESLEYAN UNIVERSITY. A coeducational institution of learning, founded at Mount Pleasant, Iowa, in 1844, under the control of the Methodist Episcopal Church. In 1902 it had an attendance of 515, including 2 graduate, 93 collegiate, and 152 preparatory students. The faculty numbered 27. The endowment was $69,000, the income $27,000, and the value of the grounds and buildings $150,000. The library contained 8000 books.

IPECACUANHA, ĭp′ē-kăk′ū-ăn′ȧ (Port., from Brazilian *ipecaaguen*, smaller wayside plant emetic, the native name). The name both of a very valuable medicine and of the plant producing it. According to the American and English pharmacopœias the source of this drug is *Cephaelis ipecacuanha* (referred by some botanists to *Psychotria ipecacuanha*), which belongs to the natural order Rubiaceæ, and grows in damp, shady woods in Brazil, and some other parts of South America. It is somewhat shrubby, with a few oblong-lanceolate leaves near the ends of the branches, long-stalked heads of small white flowers, and soft, dark purple berries. The part of ipecacuanha used in medicine is the root, which is simple or divided into a few branches, flexuous, about as thick as a goose-quill, and is composed of rings of various size, somewhat fleshy when fresh, and appearing as if closely strung on a central woody cord. The different kinds known in commerce (gray, red, brown) are all produced by the same plant, the differences arising from the age of the plant, the mode of drying, etc. Ipecacuanha-root is prepared for the market by mere drying. It is collected at all seasons, although chiefly from January to March. The plant is seldom cultivated in South America, but is sought for in the forests chiefly by Indians. It has been successfully cultivated in India, and elsewhere, but the slow growth of the plant and low price have kept it from being profitable. Various other plants are used as substitutes for it. The ipecacuanha of Venezuela is produced by Sarcostemma glaucum, of the order Asclepiadaceæ; and to this order belongs Tylophora asthmatica, the root of which is found a valuable substitute for ipecacuanha in India. Other unofficinal plants which are said to resemble ipecac in their effect are Richardsonia pilosa, Richardsonia rosea, Psychotria emetica, and various species of Ionidium. Gillenia stipulacea is called American ipecac.



IPECACUANHA.
a, Root.

It is in the bark of the root that the active principle, the emetine, almost wholly lies, the other ingredients, such as fatty matters, starch, pectine, saccharose, choline, ligline, etc., being almost entirely inert. Emetine is represented by the formula $C_{28}H_{40}N_2O_5$ according to Lefort and Wurtz, and by $C_{30}H_{44}N_2O_4$ according to Glenard. It is a white, inodorous, almost insipid powder, moderately soluble in alcohol, and having all the characters of the vegetable alkaloids. It acts as a violent emetic in doses of one-sixteenth of a grain or even less, and is a powerful poison. In small and repeated doses ipecacuanha increases the activity of the secreting organs, especially of the bronchial mucous membrane, and of the skin. In larger doses it excites nausea and depression, while in still larger doses it acts as an emetic, without producing such violent action, or so much nausea or depression, as tartar emetic. Ipecacuanha is useful as an emetic when it is necessary to unload the stomach in cases where there is great debility, or in childhood. As a nauseant, expectorant, and diaphoretic, it is prescribed in bronchitis, etc., and in disorders in which it is desired to increase the action of the skin. Besides the powder, the most useful preparations are the wine of ipecacuanha and Dover's powder, in which ipecacuanha is a constituent. To produce the full effect as a sudorific, a dose of Dover's powder should be followed by copious draughts of some warm and harmless drink.

IPEK, ē-păk′ (i.e. silk), Serb **PEČ,** pĕch. A pleasant town of European Turkey, in the Vilayet of Kosovo, on the Bistrica (Bitritsa), or White Drin, a few miles east of the eastern corner of Montenegro (Map: Balkan Peninsula, C 3). The houses are large and handsome, and as a rule have gardens in which fruit and mulberry trees are cultivated. Silk is extensively spun, and arms are manufactured. Ipek has a celebrated monastery, the former residence of the Servian patriarchs. Population, about 10,500, mostly Mohammedan Slavs.

IPHIC'RATES (Lat., from Gk. Ἰφικράτης, *Iphikratēs*). An Athenian general of the first half of the fourth century B.C. He was of humble parentage. At an early age he began his military career in the so-called Corinthian War. He was in command of the Athenian troops at Lechæum, near Corinth, in B.C. 393, where the Spartans were victorious over the allies. Immediately after he proceeded to introduce important changes in the armor and discipline of his troops. With a band of the light-armed troops, called *peltasts*, he unexpectedly fell upon and destroyed or put to rout a Lacedæmonian *mora*, six hundred strong, near Corinth. In B.C. 389 he was sent to Thrace to combat Anaxibius. By a well-planned attack he inflicted a crushing defeat upon the Lacedæmonian commander. After the Peace of Antalcidas (B.C. 387) Iphicrates remained in Thrace, employing his peltasts in the service, first of King Seuthes, and then of King Cotys. In B.C. 378 he was sent, at the request of Pharnabazus, to assist Artaxerxes II. in reconquering Egypt, but the undertaking was a failure. In B.C. 373 he was appointed joint admiral with two others to go to the relief of Corcyra, in which he was successful. In B.C. 369 he was sent to the neighborhood of Corinth to assist the Spartans against the Thebans, and later in the same year he commanded a small squadron on the coast of Macedonia. He remained in this neighborhood three years, and was instrumental in retaining the family of Amyntas on the throne of Macedonia. He later held a command in the Social War, but was arraigned, on a charge preferred by Chares, his colleague, for neglect of duty and traitorous conduct in the battle at the Hellespont. He was acquitted, though his colleague Timotheus, who was arraigned at the same time and on the same charge, was fined 100 talents. Iphicrates died in Thrace, in B.C. 353.

IPH'IGENI'A (Lat., from Gk. Ἰφιγένεια, *Iphigeneia*). According to the usual Grecian legend, a daughter of Agamemnon and Clytemnestra. Her father having offended Artemis, the Greek fleet, when on its way to Troy, was detained at Aulis by calms and a plague. Calchas, the seer, declared that only the sacrifice of Iphigenia could appease the goddess. At the altar the goddess took pity on the victim, substituted a hind, and carried Iphigenia in a cloud to Tauris, where she became priestess of the Tauric Artemis, to whom strangers were offered in sacrifice. Thither came her brother Orestes (q.v.), who was on the point of being sacrificed when he was recognized by his sister. Together they fled with the sacred wooden image of Artemis to Sparta, Argos, or, according to the Attic version, to Brauron in Attica, where Iphigenia's grave was shown. Hesiod declared Iphigenia did not die, but was by Artemis made the goddess Hecate. The legend is unknown to the Homeric poems, but was told in the *Cypria*, and later became very popular, especially through the influence of the Athenian dramatists. The story is also represented on late vases, sarcophagi, and Pompeian wall-paintings. Iphigenia is originally a goddess akin to Artemis, and worshiped in early times with bloody rites.

IPHIGENIA AMONG THE TAU'RI (Gk. Ἰφιγένεια ἡ ἐν Ταύροις, *Iphigeneia hē en Tauroia*). A play of Euripides, produced about B.C. 412, continuing the story of Iphigenia after her rescue from the sacrifice, and her transportation to Tauris, where she is made the priestess of Artemis. Orestes, pursued by Furies, comes with his friend Pylades to Tauris, and is to be sacrificed to the goddess, when he is made known to his sister in a touching scene, and carries her back to their land. The play is original, and careful in plot, and is the best known of the works of Euripides.

IPHIGENIA AT AU'LIS (Gk. Ἰφιγένεια ἡ ἐν Αὐλίδι, *Iphigeneia hē en Aulidi*). A play by Euripides, produced after his death by his son in B.C. 405. Its subject is the intended sacrifice of Iphigenia, who is saved by Artemis by the substitution of another victim. The play, which is probably the last written by Euripides, seems to have been left unfinished. Of his tragedies, it alone has no prologue.

IPHIGÉNIE, ĕ'fē'zhȧ'nē'. A tragedy by Racine, dealing with the Greek story of Iphigenia, first produced at Versailles in 1674. In the play Racine follows closely the model of the plays of Euripides, at the same time producing a separate work of art which ranks as a masterpiece. In the French play the description of the characters is more explicit than in the Greek, and some new elements are introduced, while Menelaus disappears and Ulysses is brought in to take his place.

IPHIGENIE AUF TAURIS, ĕ'fē-gā'nĭe ouf tou'rĭs (Ger., Iphigenia in Tauris). A metrical drama by Goethe produced in 1789. Goethe had previously made a prose version, begun in February, 1779, and presented at court on April 6th.

IPHIGÉNIE EN AULIDE, ĕ'fē'zhȧ'nē' äɴ'-nō'lēd' (Fr., Iphigenia in Aulis). An opera by Gluck (1774).

IPHIGÉNIE EN TAURIDE, äɴ tō'rēd' (Fr., Iphigenia in Tauris). An opera by Gluck (1779).

IPHIGENIE IN DELPHI. A dramatic poem by Friedrich Halm (1856), a continuation of Goethe's *Iphigenie.*

I'PHIS (Lat., from Gk. Ἶφις). A Cretan girl, brought up as a boy, betrothed to Ianthe, and at her mother's entreaty changed into a man by Isis on the wedding-day.

IPIALES, ē-pyä'lȧs. A town of Colombia, situated in the western part of the Department of Cauca, on the frontier of Ecuador (Map: Colombia, B 3). It lies at an altitude of over 10,000 feet, and has a custom-house. The population is estimated at over 10,000.

IP'OMŒ'A (Neo-Lat., from Gk. ἴψ, *ips*, worm + ὅμοιος, *homoios*, like). A genus of the natural order Convolvulaceæ, differing very little from the genus Convolvulus, embracing about 400 species of tropical and warm temperate plants. The species are mostly twining or trailing herbs and shrubs, although in the tropics a few become arborescent. Many are cultivated for their beautiful flowers, as the morning-glory and moonflower; others for their thick fleshy roots, as the sweet potato (*Ipomœa Batatas*) and jalap (q.v.) (*Ipomœa Purga*). The large fleshy roots of

Ipomœa Batatilla, *Ipomœa fastigiata*, and *Ipomœa digitata* are sometimes employed in the same way as sweet potatoes, and *Ipomœa megapotamica*, *Ipomœa cathartica*, and *Ipomœa Jalapa* have properties similar to jalap, though less active. The ornamental species are very numerous, and are easily cultivated. *Ipomœa Quamoclit*, the cypress vine, beautiful in both flower and foliage, is a native of tropical America, but now well established in the warmer portions of the United States. *Ipomœa versicolor* and *Ipomœa purpurea*, natives of Mexico and tropical America, are among our most common morning-glories, the latter having escaped from gardens and become naturalized throughout nearly the whole country. The famous Japanese morning-glories are referred to as *Ipomœa hederacea* by some authorities. There are many strains that have been developed by selection, some of them of very great beauty. The moonflowers are derived from *Ipomœa Bona-nox* and *Ipomœa grandiflora*. The flowers open in the evening and close before noon of the next day. They are pure white or striped with green and very fragrant. *Ipomœa fastigiata* and *Ipomœa leptophylla*, both indigenous to the United States, are noted for their large fleshy roots, specimens weighing 20 pounds of the former, and 100 pounds of the latter being not uncommon. They grow in dry soils, their thickened roots protecting them from injury by drought. *Ipomœa fastigiata*, known as man-of-the-earth and wild potato vine, in some regions is a troublesome weed, difficult of extermination on account of its huge roots. *Ipomœa arborescens*, a Mexican species, is a tree 20 to 30 feet high, and a foot in diameter. See Plate of DICOTYLEDONS.

IPSAMBUL, ēp-säm'bōōl. See ABU-SIMBEL.

IP'SUS (Lat., from Gk. Ἶψος). A town of Phrygia, Asia Minor, near the modern village of *Eski-kara-hissar*. It is noted for the battle (B.C. 301, or as Grote attempts to show, B.C. 300) in which Antigonus and his son, Demetrius Poliorcetes, were overthrown by Seleucus and Lysimachus. Ipsus was the seat of a Christian bishop in the seventh and eighth centuries.

IPSWICH, ĭps'wĭch *or* ĭps'ĭch. A town of Queensland, Australia, on the Bremer, at the head of navigation, 23 miles northwest of Brisbane, with which it has communication by steamer and rail (Map: Queensland, H 9). It has manufactures of woolens, and, as the centre of a rich agricultural and coal-mining district, is a place of increasing business importance. Population, in 1891, 7625; in 1901, 8637.

IPSWICH. The county-town of Suffolk, England, on the Orwell estuary, 12 miles from the North Sea (Map: England, H 4). The older portion of the town consists of narrow and irregular streets and contains many quaint old houses. The ecclesiastical and public buildings are conspicuous. Among its educational institutions are the grammar school founded in 1477, and a workingmen's college. It has numerous benevolent institutions. It has iron-works, agricultural implement, tobacco, clothing, shoe, and soap factories, and ship-building establishments. Its docks and lock are commodious and admit vessels of 1400 tons. The town owns profitable real estate, wharves, and markets, and maintains baths, free library with museum and school of science, and an arboretum comprising two well-laid-out pleasure grounds. Ipswich has sent two representatives to Parliament since 1447. It has Roman remains, but is first mentioned in 991 and 1000 as having been sacked by Northmen. Numerous charters, which were superseded by the Municipal Corporations Act, date from the first granted by King John in 1199. Population, in 1891, 57,400; in 1901, 66,600. Consult Wodderspoon, *History of Ipswich* (Ipswich, 1850).

IPSWICH. A town in Essex County, Mass., 27 miles northeast of Boston; on the Ipswich River, and on the Boston and Maine Railroad (Map: Massachusetts, F 2). It possesses a public library and the Manning High School. The Ipswich Historical Society, founded in 1900, possesses a collection of old furniture, documents, etc., and its contributions to historical literature also are of value. There are planing and grist mills, and manufactures of hosiery, isinglass, heels, soap, underwear, etc. The government is administered by town meetings. Population, in 1890, 4439; in 1900, 4658. Ipswich was settled as Agawam in 1633 by John Winthrop and twelve associates, and in the following year the Massachusetts General Court passed a resolution that "Agawam shall be called Ipswitch" (from Ipswich, England). When in 1687 Governor Andros levied an arbitrary tax, the town formally protested, on the ground that this tax "infringed their liberty as free English subjects of his Majesty, and the statute law that no taxes should be levied upon his subjects without the consent of an assembly chosen by the freeholders for assessing the same." Several of its citizens were thereupon arrested and punished, one of the judges asserting that English laws did not extend to America, and that colonists had no more privileges left them "than not to be sold as slaves." This was one of the earliest instances of colonial resistance to arbitrary taxation. Ipswich was the home for a time of Nathaniel Ward, Anne Bradstreet, Nicholas Easton, William Hubbard, and John Norton. Consult: Hurd, *History of Essex County* (2 vols., Philadelphia, 1888); the various articles in the *Ipswich Antiquarian Papers* (Ipswich, 1879—); and an address by Kimball, "The Evolution of a New England Town," in *The Celebration of the 250th Anniversary of the Incorporation of the Town of Ipswich* (Boston, 1884).

IQUIQUE, ē-kē'kā. A seaport and the capital of the Department of Tarapacá, in the northern part of Chile, on the Pacific Coast (Map: South America, B 5). The town is regularly built, but lies in such an arid district that its water-supply is obtained partly by distillation of sea-water, and partly by transportation from Arica. Inland are the famous saltpetre-mines for which the town is the port, and with which it is connected by a railroad, and a few miles to the north are the silver-mines of Huantajaya. The harbor is very well sheltered, but its rocky shore and the strong surf prevent the approach of vessels nearer than two miles. Besides saltpetre, the town exports borax, iodine, and silver ores. The imports are chiefly machinery and fuel for the mines. A United States consul resides here. Population, 25,000. Iquique suffered from earthquakes in 1868 and 1877. It formerly belonged to Peru, and in 1879 was the scene of a naval battle between Peru and Chile, being occupied by the latter in the following year. In 1891 it was bombarded and captured after a hand-to-hand fight by the insurgents against the Chilean Government.

IQUITO, ē-kē′tō. An important tribe, living about the junction of the Napo River with the Marañon (Amazon), Eastern Ecuador. They are expert spearmen, and are noted for their making of *chicha* liquor, which they flavor with the twigs of a plant having the effect of an opiate. In religion they are still devoted to fetichism.

IRADE, ē-rä′dȧ (Turk. *irādah*, will, desire). An Imperial decree promulgated by the Sultan of Turkey, and corresponding to the European order in council.

IRAK, ē-räk′. The name of an indefinitely bounded region extending on both sides of the confluence of the Euphrates and the Tigris, from the Syrian desert northeastward to the Elburz Mountains, on the southern shore of the Caspian Sea (Map: Turkey in Asia, L 6). The region consists chiefly of sandy deserts in the west, and elevated, mostly barren, plateaus in the east, but is fertile along the river valleys, which are especially numerous in the eastern or Persian part. The western part, called Irak-Arabi, is nearly coterminous with ancient Babylonia, and includes parts of the modern Turkish vilayets of Bagdad and Basra. It includes the ruins of the ancient cities of Babylon, Seleucia, and Ctesiphon, and the modern cities of Bagdad, Basra, and Kerbela (Meshed Hussein). The eastern Irak, called Irak-Ajemi, coincides nearly with the ancient Media, and includes a large part of Western and Central Persia, containing its largest and most flourishing cities, Ispahan, Teheran, and Hamadan. The population of the whole of Irak is estimated at about 3,000,000. The inhabitants of the western part are largely nomadic.

IRAK-AJEMI, äj′e-mē′. See IRAK.

IRAK-ARABI, -ä′rȧ-bē′. See IRAK.

IRAN, ē-rän′. The native name of Persia, in its broadest sense. (See PERSIA.) The word *Irān* itself, in its modern form, is earlier found as *Erān* (whence often Eranian as an adjective), and it is ultimately connected with *Aryan* (q.v.) as a racial designation. In the *Avesta* (q.v.) the people speak of themselves as *Airyå daiṅhavō* ('Aryan nations'), and *Ariya* in the Old Persian cuneiform inscriptions is employed in the sense of what we should to-day call Persian in the larger application of the term. As a more or less defined unit in ancient and modern times, the land of Iran is important geographically, ethnologically, historically, and linguistically.

GEOGRAPHY AND ETHNOLOGY OF IRAN. As far as modern times are concerned, the more important geographical and ethnological points connected with Iran will be found treated under PERSIA. In remote times, as later, the Iranian boundaries comprehended the entire region from the Caucasus, the Caspian Sea, and Russian Turkestan on the north, to the Tigris, the Persian Gulf, and the Arabian Sea on the west and south, and extended to the Indus on the east, likewise comprising the modern Afghanistan and the territory to the north of it as far as the Jaxartes River (Sir Darya). The wide extent of this area showed as great a variety of climate, extremes of heat and cold, in antiquity as at present, and presented considerable diversity of features and characteristics. While the larger part of the country has ever been marked as highland or mountainous, there are extensive low or depressed tracts, with salt deserts, and arid wastes, alternating with swampy districts and plains. What we know of the country in antiquity shows that it was generally fertile and well wooded in parts; but irrigation is not infrequently referred to. With regard to territorial distribution in ancient times, it may be added that in the *Avesta* the lands on the west which came more prominently into notice were the country known in history as Media (q.v.), including Azerbaijan or Atropatente (q.v.), and the districts about the Caspian Sea, and on the east, Bactria (q.v.), including the modern territories of Khorassan and Seistan, together with parts of the present Afghanistan. Persis (ancient *Pārsa*), or Persia proper, is first mentioned at the time of the founding of the Achæmenian kingdom. (See ACHÆMENES.) From that time the real history of the Iranian Empire as a whole begins. Ethnologically, the Iranian people are members of the Aryan or Indo-Germanic family. The general Iranian type may be deduced by a comparison of the racial features of the Persians, Kurds, Ossetes, Baluchis, Afghans, and inhabitants of the Pamir districts. The Iranian type, however, has been somewhat affected, even from the earliest times, by admixture with the adjoining Semitic, Turanian, and Indian tribes that border on the land itself. On the other hand, the spread of Iranian blood beyond its own country may be recognized, for instance, among the people of Northwestern India. Similarly, Iranian lineaments, like linguistic traits, may be found penetrating into Armenia and Asia Minor, even from a remote period in the past. When the gradual dispersion of the Aryan or Indo-Germanic tribes took place in prehistoric times, it is presumed that the Iranians may have entered the great plateau from the north, on the west of the Oxus and Jaxartes, and have thus begun their advance into the country that later became their habitat. Linguistic, mythological, and religious evidences prove that they must long have remained in union with their Indian cousins.

HISTORY OF IRAN. The beginnings of Iranian history are shrouded in darkness, although the existence of an ancient kingdom in Bactria is inferred from early Oriental and classical references. (See BACTRIA.) With the Median kingdom, however, we are on historic ground, even though the early tradition of a Median conquest of Babylonia, B.C. 2400, as recorded by Berosus (q.v.), may not be authentic. Nevertheless, with the presumed advance of the Iranian peoples westward in their land, the Medes came earliest into real prominence, and though subject to Assyria for centuries, they were able to throw off the Assyrian yoke about the ninth century B.C., and real unity was given to the Median kingdom in the eighth century by Deioces, an able Iranian monarch. (For the subsequent history of the kingdom, see MEDIA.) The account of the overthrow of the Median dynasty by Cyrus (about B.C. 550), and the events which led to the founding of the great Persian Empire of the Achæmenian kings, and to its fall through Alexander the Great, will be found in the several articles devoted to those topics. The Seleucid dynasty (see SELEUCIDÆ) swayed the fortunes of Iran for about seventy years, and gave place to the Parthian dynasty of the Arsacidæ (q.v.), which reigned for nearly five centuries (B.C. 250-A.D. 226). This rule yielded in turn to the Iranian monarchy of the Sassanidæ (q.v.). The overthrow of this house by the Arab Mohammedan invasion in the seventh century changed the history of Iran, nationally, religiously, and linguistically. For details of these events, consult the article PERSIA.

BIBLIOGRAPHY. The standard work relating to all Iranian subjects is Geiger and Kuhn, *Grundriss der iranischen Philologie* (Strassburg, 1895-1902), where the fullest bibliographical references will be found. Besides this work, for the general history and antiquities of Iran, consult: Rawlinson, *Seven Great Monarchies of the Ancient Eastern World* (London, 1865); Spiegel, *Eranische Altertumskunde* (3 vols., Leipzig, 1871-78); Geiger, *Civilization of the Eastern Iranians* (trans., London, 1861-76); Curzon, *Persia and the Persian Question* (London, 1892).

IRA'NIAN, or ERANIAN. The term applied to peoples, some of which are now almost or altogether extinct, speaking languages belonging to the Aryan stock, and inhabiting the plateau lying between Asia Minor and the Caspian on the west and the Hindu Kush Mountains on the east (of which modern Persia forms the chief part). The chief Iranian peoples are the Persians (Tajiks of the East; Hajemis of the Caspian littoral, and the Teheran-Ispahan country; Parsis, now principally resident in Western India, but also in the region between Ispahan and the Persian Gulf), ancient and modern, and the old Bactrians, whose descendants are said to speak still a purer Persian than that in vogue in Persia itself, together with the partly civilized Kurds; while the Tats and Azerbaijanis, the Sarts of Russian Turkestan, and certain portions of the population of Afghanistan, Baluchistan, etc., are physically Persians who speak, more or less, Turkic dialects. Earlier authorities classed the Armenians and the Ossetes with the Iranians, but it is better to regard these two as independent members of the Aryan stock. The mass of the Aryan tribes of Afghanistan and Baluchistan, by some considered Iranian, show on the whole greater affinities with the Aryans of Hindustan. The Golchas of Pamir are rather an independent Aryan branch than a subdivision of the Iranians. From the dawn of history the land from the borders of Asia Minor to the mountains of Pamir has been inhabited, generally speaking, by tribes and nations of Aryan stock, and chiefly of the variety called Iranian. Even beyond the Oxus, the traditional frontier between Iran and Turan, Iranian culture, old and new, can be traced beyond the borders of China, and no doubt some of the nomad hordes who hovered about Western Europe were not all Turanian in their make-up. Within the Iranian area many blends exist. Besides the descendants of the Aryan Medes and Persians of a fairly pure strain, and the purer Eastern Iranians, almost every people of Asia Minor and of Central Asia has added its quota to the hybrid populations. Mongolian, Arabian, Turkish conquests, and the commercial and colonizing instincts of Jews, Armenians, natives of the Caucasus, etc., have also contributed their share to the mixture. War, slavery, and peaceful nomadism have likewise helped, both in ancient and in modern times. The range of culture of the Iranians is very extensive, reaching from the civilizations of ancient Bactrians, Medes, and Persians (and their modern representatives) to the half-savage seclusion and isolation of some of the small hill-communities. Most authorities do not assign to the Iranians as high a rank intellectually as is possessed by the Aryans of India or by the Semites, to say nothing of the Aryans of Europe. The situation of the plateau of Iran between India and China on the one hand and Asia Minor and Arabia on the other has made it inevitably an absorber and a transmitter of culture, a highway of commerce, and a theatre of religious disputes. The great mass of the Iranians are now professors of Islam, but of the Shiite or 'unorthodox' sort, a protest, as it were, of the Aryan against the Semitic mind. The ancient Aryan religion, Zoroastrianism, indigenous to the Eastern Iran, with its dualism and reverence of fire as the sacred symbol, exercised considerable influence upon the Hebrews. Some of the Iranians (Persians and Parsis in particular) have from time immemorial been devoted to commerce, and have spread Persian influence to the Red Sea on the west, and to the western shores of India in the other direction, while northward they have carried it into Siberia and China. The best side of the Iranians of the present time is seen in the educational and charitable activities of the great Parsi merchants of India, who in many respects are setting examples for the whole world. The worst is seen in some of the aspects of Persian tyranny. All grades between still exist here and there over the wide Iranian land. The Iranians in general are judged by Ripley to belong physically to the 'Mediterranean' race, their ideal type represented to a certain extent by the Farsis about the ancient Persepolis and the Luris of the mountains of Western Persia, having been modified in the southwest by the Semitic intruders, in the east and northeast (the mass of the people) by Mongolian admixture, and on the littoral of the Arabian Sea toward the southeast by Indian, or perhaps Negritic, additions. See IRANIAN LANGUAGES.

BIBLIOGRAPHY. Besides the authorities mentioned under the subdivisions of the Iranians, the following more general works may be mentioned here: Spiegel, *Eranische Altertumskunde* (Leipzig, 1871-78); Ayuso, *Iran* (Madrid, 1876); De Harlez, *Etudes Eraniennes* (Paris, 1880); Fontane, *Les Iraniens* (Paris, 1881); Spiegel, *Eran* (Berlin, 1883); Darmesteter, *Etudes Eraniennes* (Paris, 1883); De Morgan, *Mission scientifique en Perse* (Paris, 1884-97); Geiger, *Civilization of Eastern Iran in Ancient Times* (Eng. trans. London, 1885); Spiegel, *Die arische Periode und ihre Zustände* (Leipzig, 1887); Binder, *Au Kurdistan, en Mésopotamie et en Perse* (Paris, 1887); Houssaye, *Les peuples actuels de la Perse* (Lyon, 1887); Dieulafoy, *La Perse, la Chaldée et la Susiane* (Paris, 1887); Brunnhofer, *Iran und Turan* (Leipzig, 1889); id., *Vom Pontus bis zum Indus* (1890); and the sections on the Persians and Iranians in Ratzel, *History of Mankind* (Eng. trans., London, 1898), and Ripley's *Races of Europe* (New York, 1899).

IRANIAN LANGUAGES AND LITERATURES. Historically, the linguistic and literary monuments of Iran cover a period of more than two thousand five hundred years, dating from the early Zoroastrian scriptures and the Old Persian cuneiform inscriptions, through the Pahlavi, down to Modern Persian literature. From the standpoint of speech the Iranian tongues are most closely allied to the Indic languages, and together they make up the Indo-Iranian group (q.v.). Three great periods in their development may be recognized—Old Iranian, Middle Iranian, and New or Modern Iranian. (1) The first of these, the Old Iranian period, includes the *Avesta* (q.v.) and the cuneiform inscriptions, and antedates the Christian Era by fully six centuries, although it probably extended into the fourth century A.D. There is practically a barren period of five centuries during the Parthian sway, from the third century B.C. to the early part of the third century A.D., during which time there are no real literary monuments, although possibly some later Avestan texts may have been composed, and certain inscriptions and devices in coins may be cited as helping to eke out our knowledge of the Old Iranian period till the rise of the Sassanian monarchy (A.D. 226). (2) The Middle Iranian period dates from the latter event, and extends to about the ninth or tenth century of our era. It is represented by the language and literature known as Pahlavi (q.v.), including Huzvaresh, Pazand, and Parsi. (3) The New or Modern Iranian period begins practically in the tenth century A.D., with the rise of the Modern Persian language and literature (q.v.) under Firdausi (q.v.), and his immediate predecessors. Within this period, besides the New Persian, there come the various modern Iranian languages and tongues, Afghan, Baluchi, Kurdish, Ossetish, the dialects of the Pamir and Caspian districts, and the dialects of Central Iran. All the Iranian languages have certain phonetic characteristics which mark them and distinguish them from the kindred group of Indic tongues. Most conspicuous among these are: (1) The change of Indo-Germanic *s* into Iranian *h*; e.g. Skt. *samá*, 'same,' 'like,' 'all' = Av. *hama*, OPers. *hama*, Phl. *hamak*, Paz. *hamā*, NPers. *hamah*, Bal. *hama(k)*, Kurd *hamū*; (2) the presence of the voiced sibilants *z*, *ž*, e.g. Skt. *jānu*, 'knee' = Av. *zānu*, Phl. *zānūk*, NPers. *zānū*, Afgh. *zangūn*, Bal. *zān*, Kurd. *zān*; Skt. *bāhú*, 'arm' = Av. *bāzu*, Phl. *bāzīh*, *bāzuk*, NPers. *bāzu*; Skt. *mṛḍīká* (Vedic *mṛḷīká*), 'mercy' = Av. *marəždika*; (3) the use of spirants instead of aspirates, as well as a general tendency to spirantization (*th*, *θ*, *gh*, *γ*, etc.); (4) there are numerous minor phonetic, morphological, and syntactical features which can be discussed only in a technical treatment of the individual languages concerned. The details regarding the various Iranian literatures, Avesta, Old Persian, Pahlavi, etc., will be found in the separate articles devoted to those subjects. The modern Iranian languages are written in the Arabic script, the ancient Persian inscriptions in wedge-shaped letters borrowed from the Babylonian characters, while the Pahlavi and Avesta are in a script based on the Semitic writing and read from right to left.

Consult: Linguistic monographs in Geiger and Kuhn, *Grundriss der iranischen Philologie* (Strassburg, 1895-1902); Gray, *Indo-Iranian Phonology* (New York, 1902).

IRAPUATO, ē'rȧ-pụ-ä'tō. A district town in the Mexican State of Guanajuato, situated on the Mexican Central Railroad, 33 miles from Guanajuato, the capital of the State (Map: Mexico, H 7). Its climate is so equable that strawberries are marketed the year round. It has a number of old convents and churches. Population, in 1895, 18,593.

IRAWADI, ĭr'ȧ-wä'dĭ. A river of Farther India. See IRRAWADDY.

IRAYA, ē-rä'yȧ. A Malay-Negrito people in Isabela Province, Luzon; also called Malingas. See PHILIPPINE ISLANDS.

IRBIT, ēr-bēt'. The capital of a district in the Russian Government of Perm, situated at the confluence of the Irbit with the Nitza (Map: Russia, K 3). It is famous chiefly for its annual fair, instituted in 1643 and second only to that of Nizhni-Novgorod. It lasts the whole month of February, and is visited by about 20,000 people. The chief articles of commerce are manufactures from Russia, textiles and tea from the East, animal products from Siberia. The annual value of goods brought to the fair exceeds $20,000,000. Irbit has steam communication with some ports on the rivers Tobol, Irtysh, and Obi. Irbit was founded by the Tatars in 1633. Population, in 1897, 20,064.

IREDELL, ĭr'dĕl, JAMES (1750-99). An American jurist, born in Lewes, England. He was the son of a wealthy and influential British merchant largely engaged in the American trade, who secured for him a position in the customs service of North Carolina. He entered as a deputy collector in 1767, finally becoming in 1774 collector of royal customs for the entire colony. Meanwhile he had studied law, and had been admitted to the bar. In the pre-Revolutionary controversies between England and the colonists he openly showed his sympathy with the cause of his adopted country, resigned the collectorship, and entered enthusiastically into the work of organizing the Revolutionary Government. The necessity for a reorganization of the law courts appealed to him particularly, and to this work he devoted his best efforts. In December, 1777, he was chosen a judge of the North Carolina Supreme Court, and in 1787 was commissioned by the Legislature to revise and codify the statutes of the State, which resulted in the important publication known as *Iredell's Revision of the Statutes of North Carolina* (1791). He was an ardent Federalist, but with his political associates could not overcome the opposition which prevented North Carolina from accepting the Constitution until several months after Washington's inauguration. In February, 1790, he was named by President Washington as associate justice of the United States Supreme Court, in which capacity he served until his death. Consult McRhee, *Life and Correspondence of James Iredell* (1857).

IREDELL, JAMES (1788-1853). An American jurist and legislator, son of Justice James Iredell of the United States Supreme Court. He was born at Edenton, Chowan Co., N. C.; graduated at Princeton in 1806, studied law, and was admitted to the bar in North Carolina. In the War of 1812 he raised and commanded a company of North Carolina volunteers. His political career began in 1816, with his election to the State Legislature. To this body he was repeatedly reëlected, was Speaker of the Lower

House in 1817-18, and, with the exception of a short term on the bench of the Superior Court in 1819, served until his election as Governor of the State in 1827. In the following year he succeeded Nathaniel Macon in the United States Senate, serving until 1831, when he retired permanently from public life and resumed the practice of law. He was a commissioner to revise the statutes of North Carolina, the result of his labors being the publication of the *Revised Statutes* (1836-37), and as the reporter for the Supreme Court of the State for many years he compiled twenty-one volumes of *Reports*. He also published a *Treatise on the Law of Executors and Administrators* (1837), and *Digest of Reported Cases in the Courts of North Carolina, 1776 to 1845* (1839-46).

IRELAND, Ir′land. The smaller of the two great islands forming the United Kingdom of Great Britain and Ireland. It rises from the continental shelf amid shallow waters, the line marking a depth of 600 feet running from 25 to 100 miles west of the Irish coast. Beyond this line the bed of the Atlantic slopes rapidly to oceanic depths. Ireland is thus essentially a part of Europe, and lies on the western rim of the mighty land mass of Eurasia. Its area is 32,583 square miles, including about 500,000 acres in water areas. Ireland extends through nearly four degrees of latitude, from the parallel of 51° 26′ N. to that of 55° 21′.

TOPOGRAPHY. On the east, along the waters of the Irish Sea and Saint George's Channel, which separate Ireland from England and Wales, the coast is comparatively straight for long stretches, and has few deep indentations. On the west, however, where the coast is exposed to the gales of the Atlantic, the sea penetrates far into the land through long, deep valleys. These valleys are true fiords like those of the west coasts of Scotland and Norway, and, as in those countries, at the entrance to the inlets and all along the coast there are hundreds of little islands that were torn from the mainland mass by ocean storms and other destructive influences. The northwestern edge of Europe, therefore, has the same general characteristics from Bantry Bay, at the southwest corner of Ireland, to the North Cape, far north of the Arctic Circle in Scandinavia. The chief ports of Ireland are Belfast, Dublin, Waterford, Cork, and Londonderry. The west-coast ports are of little importance except in the coasting trade.

In its general surface Ireland may be described as basin-shaped. A traveler sailing along the coast waters might get the idea that Ireland is very mountainous. As he nears the coast from Holyhead—the common route from England to Dublin—he sees the blue line of the Wicklow Mountains rising 2000 feet above the sea. The details come into view as he approaches Dublin. He sees the rounded bosses of Killiney and the grim promontories of Howth and Bray, which are only the outliers of the high granite moorlands that stretch away for 70 miles to the south. Farther north, between Dundalk and Dundrum bays, he sees a still more rugged and picturesque coast, with the huge domes of the Mourne Mountains rising above it; and then at Belfast come into view the long, black scarps, terraced and uninviting, which form the edges of the high plateau behind them. Rounding the north coast, he sees along the Atlantic shores of Donegal and Mayo great walls of rock, 2000 feet high in places, the finest cliffs in the British Isles; and down the west coast are the rugged heights of Connaught, the high limestone terraces of northern Clare, and, farther south, range after range extends along the shores till they culminate in the gray masses that look down on Bantry Bay. The highest peak is Carrantuo Hill (Carran Tual), near the picturesque Lakes of Killarney, which has an elevation of 3,414 feet above the sea. The interior of the northern portion of the country, from the latitude of Belfast, is partly broken and mountainous. The same is true of the southern part of the island a little south of the latitude of Dublin.

Broadly speaking, therefore, the highlands of Ireland are masked upon its margin. The central area is a wide depression, in which numerous bogs and lakes have formed. When the traveler crosses Ireland, from Dublin to Galway (115 miles), for example, he meets scarcely a hill on the way. He may travel over large parts of the central regions and feel himself on a great plain above which hills or ranges of elevated surface rise here and there, though they are quite insignificant in comparison with the wide expanse of brown bog or level meadow land.

HYDROGRAPHY. There is no well-defined water-parting feature in the country with rivers radiating from it. There is, therefore, no reason why a stream rising in one of the central counties should flow to the Irish Sea rather than to the Atlantic Ocean. The central plain, in fact, is a gathering ground for the waters that flow down the inner slopes of the bordering hills, and for the rock waste that they carry with them. Most of the plain is not over 500 feet above sea-level. The water parting between the eastern and western rivers may be traced from Lough Foyle to Mizen Head; but it is a winding line, marked by no definite and determining surface features.

The rainfall is abundant in the central plain, with the result that the slow-moving rivers widen into long lakes or loughs. The Shannon and Erne rivers are formed by these lakes, joined by stretches of river, the river sections being not very much longer than the lakes. The northern part of the central plain is drained by the Erne. The centre of the plain is drained by the Shannon, which empties into the Atlantic through a wide estuary 70 miles in length. The Shannon, 250 miles long, is the longest river in the United Kingdom. Nearly half of it above the estuary is made up of the three lakes Allen, Ree, and Derg. All the most important rivers rise on the plain, the mountain streams being too limited in length and drainage area to have large volumes. Some of the plain streams, like the Boyne, are true rivers, and not made up partly of lakes. A few of these sluggish rivers serve as means of communication with the interior, and their usefulness is augmented by the considerably developed canal system of the country. The Shannon River, navigable by large steamers for 129 miles, is connected with Dublin by the Grand and Royal canals, thus affording water communication across the island. Bogs covering a large part of the plain are the source of peat, so extensively used in Ireland for fuel. The Bog of Allen, to the east of the centre of the plain, is the most extensive of these wet, barren regions.

CLIMATE. The most potent factor in determining the climate of Ireland is the Atlantic Ocean. The prevailing westerly winds blowing over the broad expanse of water are tempered by the influence of its comparatively warm surface, so that the mean winter temperature of Ireland is 20° to 30° F. higher than that of places on the same parallels of latitude in America and in Western Russia. The influence of the equable sea climate is also very pronounced in summer, the mean summer temperature of Ireland being from 5° to 10° F. lower than that of Eastern Prussia. Ireland has the greatest advantages, both as to temperature and rainfall, that an insular climate affords. It also has the disadvantages, as, for example, the unpleasant damp winds that sweep in from the ocean, and the fog and mist that hang around the flanks of the hills. The large average rainfall clothes Ireland with the vivid garb of green that has made it known as 'the Emerald Isle.' The largest rainfall is in the hilly and mountainous districts bordering the island on the west, south, and east sides. The drier region is the central plain. The averages for the wetter districts were 43.56 inches in 1879 and 36.36 inches in 1896; the averages for the drier central plain were 34.39 inches in 1879 and 34.07 inches in 1896.

SOILS. The fertility of Irish soils has long been recognized. About half of the island is formed of limestone, whose soils are proverbially rich. The red marls, calcareous grits, slate, and igneous rocks have also contributed fertilizing elements. The fact that the former glacial conditions transported the rocks of many localities and mixed them with those of others has, as in England, been very beneficial to the agricultural interests. Thus limestone detritus from the central plain was spread over hundreds of thousands of acres outside of it, contributing elements of fertility which the local rocks did not possess. In some regions the soil is naturally poor, and in many others bad tillage or overcropping has reduced fertility. Bog and barren mountain lands cover about one-fifth of the total area.

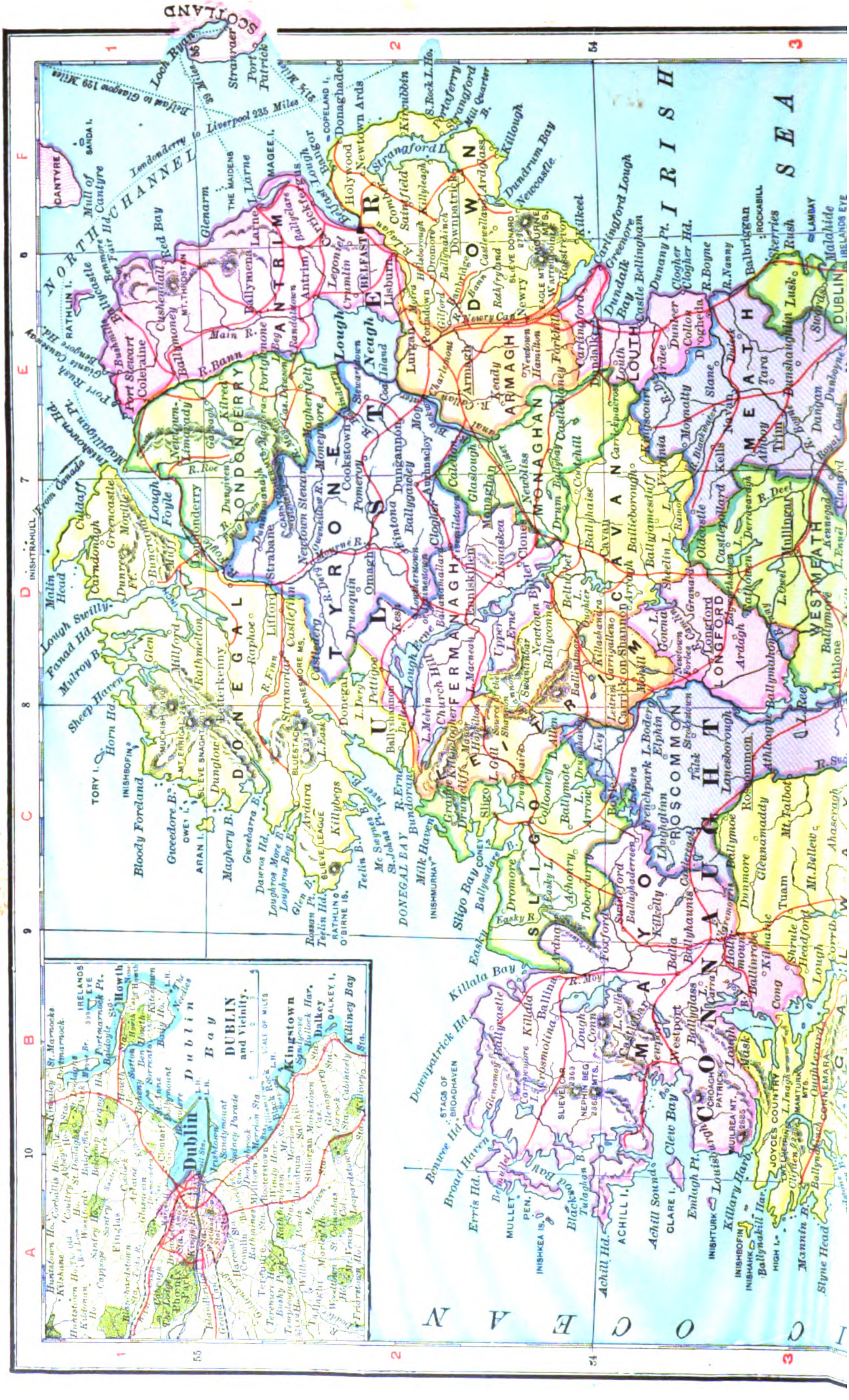
FLORA. The Irish flora consists largely of English migrants, and England in turn derived most of her flora from the neighboring continent. The sedges, rushes, and ferns are most abundant in the wetter west. Grass is by far the largest product of the soil in every county of Ireland. The pastoral lands (permanent grass) include about four-fifths, and the arable lands (cereal, root, and fibre crops, and hay under rotation) one-fifth of all lands utilized for agricultural and stock-raising purposes. The forests (chiefly oak and beech in the lower grounds, and birch and pines in the higher regions) cover only a very small part of the area.

FAUNA. The fauna differs in no marked degree from that of England or France, and is largely a thing of the past. The great Irish deer and the garefowl (q.v.) were exterminated in prehistoric times; and since civilization began Ireland has lost its bear, wolf, wildcat, beaver, native cattle, and other species of mammals and birds. Nothing remains except the small rodents of the woods and fields, and such small birds as belong to the fields, gardens, and seashore. The popular saying that there are no snakes in Ireland is true; but there are none in Scotland, and only two species in England. British standard works on natural history cover Ireland, but it has had also a special treatise of high repute in Thompson, *Natural History of Ireland* (London, 1849-51).

GEOLOGY. The central plain of Ireland is underlaid by limestone strata belonging to the basal portion of the Carboniferous system. Upper Carboniferous rocks, including the coal measures, were originally developed on an extensive scale, but they have been removed by erosion, and are now found in only a few localities. The highlands bordering and partially inclosing the central plain have a more varied character. In the northwest—in Donegal, Derry, Mayo, and the District of Connemara—the mountain axis consists of crystalline rocks, which give way on the flanks to upturned Paleozoic sediments. This structural type is repeated in the southeast, in the highlands of Leinster. The northern counties are floored largely by Silurian rocks, although there are small areas where the Permian, Cretaceous, and Triassic formations outcrop. The Giant's Causeway (q.v.) and the bold cliffs of the northern coast owe their character to basalt intrusions. In the southwestern highlands the Old Red Sandstone appears along the central ridges which are the axes of anticlinal folds, while the synclinal folds consist of Carboniferous limestone.

MINING. Irish coal resources are insignificant compared with those of Great Britain—a fact which has placed Ireland at a serious industrial disadvantage. During the last years of the nineteenth century about 24 mines were in operation, employing 1000 persons and yielding about 125,000 tons annually. The greater part of the output of coal is of the anthracite variety. The iron-ore resources are more considerable, but in the absence of coal have not been extensively exploited. The annual output during the last years of the nineteenth century was about 100,000 tons, almost the whole of which was mined in County Antrim. The mining of copper, which was of some importance for many years, has almost ceased. In 1900 the aggregate value of all minerals was £239,740.

FISHERIES. The fishing industry, stimulated by a system of bounties and the necessity of drawing upon the resources of the country in consequence of the growth of population, was very active about the beginning of the nineteenth century. In 1829 there were 64,771 men engaged in the industry; but the cessation of the bounties in that year caused a decline. Still more disastrous was the result of the famine period (1846), due to the blight and failure of the potato crop, and only in recent years has there been a revival in the industry. Deep-sea and coast fishing employed 6500 vessels and 26,073 men in 1900, as against 6458 vessels and 24,528 men in 1881. The total annual value of the catch, including shell-fish, fluctuates about £300,000. Salmon-fishing is extensively pursued along the rivers and the coasts, employing from 12,000 to 13,000 men and yielding an annual product of about £300,000. The haddock fisheries are carried on in the region to the east of the Leinster coast, hake fisheries on the southern coast, and mackerel on the west coast. The revival of the fishing industry


SCOTLAND
NORTH CHANNEL
IRISH SEA
OCEAN
ULSTER
CONNAUGHT
LEINSTER
DONEGAL
LONDONDERRY
ANTRIM
TYRONE
DOWN
ARMAGH
FERMANAGH
MONAGHAN
CAVAN
LOUTH
MEATH
WESTMEATH
LONGFORD
ROSCOMMON
SLIGO
LEITRIM
MAYO
DUBLIN
Belfast
Londonderry
Lough Neagh
Lough Foyle
Lough Swilly
Donegal Bay
Sligo Bay
Killala Bay
Clew Bay
Achill I.
Tory I.
Malin Head
Rathlin I.
Belfast to Glasgow 129 Miles
Londonderry to Liverpool 235 Miles
DUBLIN and Vicinity
Dublin Bay
Dublin
Kingstown
Howth
Killiney Bay
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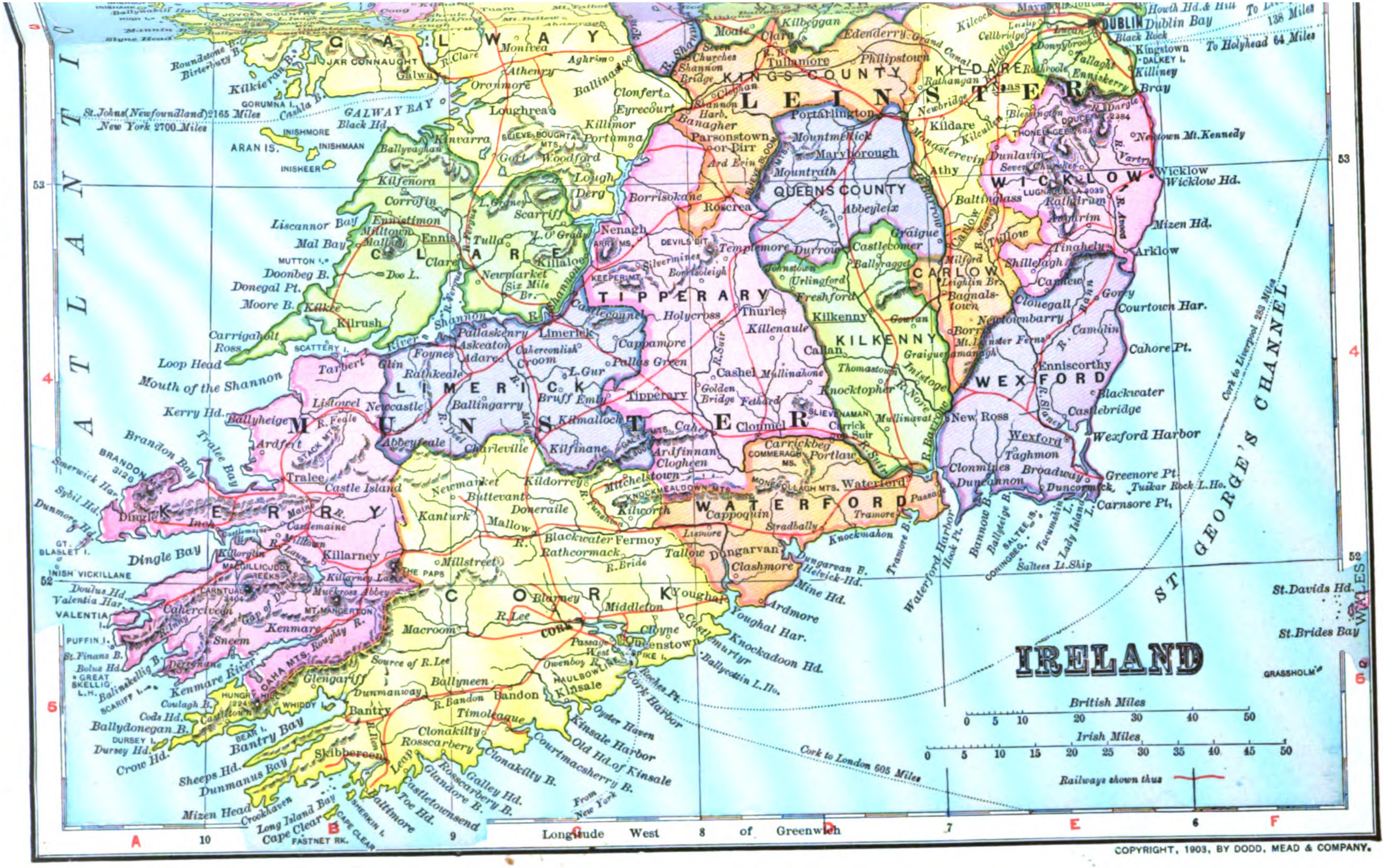

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has been greatly encouraged by the Government as one of the means of bettering the conditions of the poverty-stricken population. Piers and harbors have been built for the benefit of fishermen, money loaned them, and their interest protected by close inspection.

AGRICULTURE. As a result of natural and historical conditions, the industrial activity of Ireland is largely confined to agriculture. Few countries have so large a percentage of area adaptable for cultivation. Most of the waste lands are in the mountains of Western and Southern Ireland, though there is still much unreclaimed boggy area in the lowlands. The lowland region is naturally of a high degree of fertility. The climate is warm and humid, and consequently favorable to the growth of most plants, though the humidity is too great in some regions to allow wheat to ripen properly. While the country is favored by nature, the Irish system of agriculture does not result in the general welfare of the people, as may be understood in a study of Irish history. One of the features of the English subjugation of Ireland was the confiscation of the greater portion of the land, and the granting of it in large dimensions to English citizens. These in many instances were non-residents, and even when residents they did not always succeed in establishing cordial relations with the tenantry, who were not forgetful of the manner in which the landlord (as a class) came to his possession. During the eighteenth century Ireland was placed under the ban of the English commercial and colonial policy, and Irish agricultural products were excluded from the English markets. Later these restrictions were removed, and the high prices of the Napoleonic war period gave a decided impetus to agriculture. During the first part of the nineteenth century there was a general movement toward the division of the farms into small holdings—the result largely of the landlords' desire to secure greater political strength through the increase in the number of ballots, and of the extensive practice of subletting indulged in by the middlemen.

The potato blight of 1845 precipitated a crisis, and important changes date from this event. In great measure it marked the beginning of the end of the small holding, and the change from tillage to pasturage. The repeal of the Corn Laws aided in the relief of the Irish, but later so diminished the value of Irish cereals in the English markets that the landholders in the lowland regions evicted their tenants and turned the lands into pasture-fields. The evicted tenants had to seek a location in the less desirable regions. In Ulster the tenant fared somewhat better; for there custom had long recognized a sort of tenant right, which operated to restrict the privileges of the landlord. The great diminution of the population through emigration had the effect of providing more labor for those who remained, though too often the location of the laborer was remote from the labor. On the whole the condition of the peasantry improved. But the fact that tenant and landlord were of different race and religion still prevented the development of sympathetic and harmonious relations between the two, and the prevalence of tenantry at will resulted in an aggravating uncertainty of tenure, and prevented the discouraged tenant from making such effort to improve his holding as his interests demanded. Accordingly the land question persisted and became more serious. Relief was sought through the legislative act of 1870, granting compensation for improvements and for the disturbance occasioned by removal, and through the act of 1881, which provided for a fair rent, fixity of tenure, and free sale.

The period for which rent might be fixed according to the law of 1881 was fifteen years, at the conclusion of which time it might be fixed again for another fifteen years. From 1881 to 1900 the number of holdings for which the rent was fixed for the first fifteen years was 328,720, embracing 9,859,970 acres, the per cent. of the reduction in rent being 20.8. Those upon which rent was fixed for the second fifteen-year period during that time was 52,396, embracing 1,432,615 acres, upon which there was an additional rent reduction of 22 per cent.

A still more radical move was represented by the policy of enabling the peasant to purchase land. The Government advances money for the purchase of the lands, and the peasant pays the Government in annual installments for a term of years. In accordance with the act of 1885 and its amendment of 1888, there had been, prior to April, 1900, 25,368 loans, or a total of £9,992,640, issued to tenants to assist them in purchasing their holdings. Laws passed in 1891 and 1896 provided for the further purchase of land, and under these acts 19,227 loans of £6,084,217 were issued. The total number of loans issued in Ulster was more than twice as great as in any other province, although the amount did not very greatly exceed that of Munster. Less than one-fourteenth of the total amount went to the Province of Connaught. Under the land-improvement acts loans were issued between 1847 and 1900 amounting to £5,239,220.

The following table gives the number of holdings by provinces, grouped into nine different classes (1900):

HOLDINGS (IN ACRES)

PROVINCES	Not exceeding 1 acre	From 1 to 5 acres	From 5 to 15 acres	From 15 to 30 acres	From 30 to 50 acres	From 50 to 100 acres	From 100 to 200 acres	From 200 to 500 acres	Above 500 acres	Total
Leinster	24,301	17,426	25.255	21,952	15,222	14,039	6,890	2,829	411	128,325
Munster	21,949	11,493	19.349	24.288	22,271	22,602	9,325	2,680	383	134,340
Ulster	18,962	20,672	63.555	53,622	24,989	14,461	3,725	1,031	263	201,280
Connaught	6,636	12,563	46,592	33.688	11,567	6,474	3.111	1,679	482	122.792
Totals for Ireland	71,848	62,154	154,751	133,550	74,049	57,576	23,051	8,219	1,539	586,737

Compared with 1881, there has been a decided increase in the holdings of less than one acre (20,852), and an increase in all groups of 50 acres and up as follows: Farms in the group 30 to 50 acres increased in number 1664; 50 to 100 acres, 1975; 100 to 200 acres, 837; 200 to 500 acres, 15; and the number in the group above 500 increased 109. The three remaining groups decreased as follows: The 1 to 5 acre group decreased 4917 in number; the group 5 to 15 acres, 9264; and the group 30 to 50 decreased 2263.

With regard to the change from tillage to pasturage since the famine, the decrease was greatest for cereals. This acreage was 2,832,564 in 1855, and only 1,317,574 in 1901. The decrease in the root crops was also large, the total acreage being 1,444,390 in 1855, against 1,079,443 in 1901. The meadow crops increased during the same period from 1,314,807 to 2,178,592 acres. The following table shows in more detail the changes which took place in the period 1855 to 1901:

YEAR	Oats (acres)	Meadow (acres)	Wheat (acres)	Barley (acres)	Flax (acres)	Potatoes (acres)	Turnips (acres)	Mangel-wurzel and beet root (acres)	Total (acres)
1855	2,118,858	1,314,807	445,775	226,629	97,075	982,301	366,953	22,567	5,574,965
1890	1,221,013	2,093,634	92,341	182,058	96,896	780,801	295,386	46,457	4,808,586
1901	1,099,335	2,178,592	42,934	161,534	55,442	635,321	289,759	77,457	4,540,374
Rate per cent. increase or decrease	—48.1	+65.7	—90.4	—28.7	—42.9	—35.3	—21.0	+243.2	—18.5

It will be seen that the largest actual decrease was shown by oats, but the largest per cent. decrease was in wheat, the growing of the latter crop having become altogether unimportant. The continued decrease in the cereal crops in the last third of the nineteenth century is attributed to the fall in price of those commodities resulting from foreign competition, together with the superior adaptability of Irish soil for pasturage. Cereal production is carried on in all the provinces, but oats are most important in Ulster, and the raising of barley is largely centred in Leinster. Potatoes still constitute the most important food staple grown in Ireland; the average acreage, however, has fallen off nearly one-third since 1850.

In 1901 the area under crops, including clover, sainfoin, and grasses for hay, amounted to 3,069,789 acres, the area under grass, including temporary pasture and hay mown on permanent pasture, 12,138,500 acres; under small fruit and fallow, 10,886 acres; under woods and plantations, 309,741 acres; under bog waste, barren mountain, water, and marsh, 4,804,428 acres.

STOCK-RAISING. The increased importance of stock-raising in the last half of the nineteenth century is shown from the fact that the number of cattle per 1000 acres of the total area increased from 143 in 1851 to 230 in 1901, while the number of sheep per 1000 acres increased from 102 to 215, and the number of hogs increased from 52 to 60 during the same period. The large number of cattle is particularly noteworthy, there being in Ireland more head, area for area, than in any other European country. The number of milch cows decreased both relatively and absolutely during this period, the number in 1901 being 1,482,483, or 31.7 per cent. of the total number of cattle. In the last years of the nineteenth century, however, the number of milch cows showed a tendency to increase. The short-horned variety of cattle predominates. The following table shows the number of the different varieties of domestic animals for the years 1881 and 1900:

	Horses	Mules	Asses	Cattle	Sheep	Pigs	Goats	Poultry
1881	548,374	26,392	187,143	3,956,595	3.256,185	1,095,830	266,078	13.972,426
1900	566,978	30.678	242,247	4,608,550	4,386,876	1,268,521	306,078	18,547,307

A peculiarity of stock-raising in Ireland, especially cattle-raising, is that a large proportion of the animals marketed each year is not prepared for the market in Ireland, but is shipped to Great Britain for that purpose. Ireland is not excelled in the production of the grade of horses of the hunter type, this type being raised mainly in the country south of the Boyne River. Heavy cart-horses are raised principally along the eastern seaboard from Wexford to Londonderry. On the western seaboard, especially in Galway and Mayo, ponies are the predominating breed. The raising of horses for general purposes is more widely distributed, with Ulster in the lead. It will be seen from the above table that the rapidly growing poultry industry has attained large proportions. A significant development latterly has been the growth in agricultural coöperation. There was one coöperative society in 1890; in 1901 there were 187 dairy and agricultural societies with 81 auxiliaries; 106 agricultural societies; 102 coöperative banks; 29 poultry societies; 46 miscellaneous societies; and 2 federations—making a total of 553 societies, having an aggregate membership of 51,000. Ulster leads in the movement; Leinster falls furthest behind.

MANUFACTURES. The manufacturing industries are of comparatively little importance. The adverse conditions imposed upon them in former centuries by the British Government hampered their development, and the absence of local coal resources and the general non-prosperous condition of the social life of the country have limited its development in recent years. The history of the manufacturing industries, however, is a record of long and desperately continued struggle, and is not without its periods of success. In scope the industries have been largely confined to the textiles—wool, linen, and silk. Prior to the time of Charles II. manufactures of Irish woolens were well known in many colonial and foreign markets. But the navigation acts in the reigns of Charles I. and II. cut Ireland off from the British market, while those of William III. severed Ireland from all foreign markets. The country could only export woolens to the English markets under heavy duty, thus limiting it practically to the local home market. When the American Colonies revolted, these restrictions were removed. But by this time the industry had secured so great a lead in England that with the additional advantage given to the latter country through the abundance of coal which now began to supply power for the industry, Ireland was not able to regain its former prominence. The best known of the Irish woolens are the tweeds. They are noted for their durability. In 1899 there were 3323 persons employed in the manufacture of woolen, worsted, and shoddy goods.

The manufacture of linen by the Irish was not at first so detrimental to English interests as was the manufacture of woolens, and it fared much better at the hands of the Government. Indeed, for a period, the linen industry became prominent as the woolen industry decreased. The Lord Deputy Strafford and his successor, Ormond, did all within their power to encourage the industry, as did both the Irish and the English Parliaments—the latter allowing the products to enter England free of duty. The superior methods of manufacture in vogue in France and the Netherlands were studied, and attempts were made to induce skilled workmen from these countries to migrate to Ireland. With these and other advantages, the industry increased, but only at last to excite the ill will of England, which closed its markets to many varieties of the Irish products, and thus seriously hampered the industry in spite of the generous aid it continued to receive from the Irish Government. The 'wet spinning' process of linen manufacture was introduced between 1825 and 1830, and the factory system grew rapidly. The extreme moisture in the atmosphere gives to Irish linen that delicate whiteness which is unobtainable in any other country. The number of spindles used in its manufacture increased from 396,338 in 1850 to 826,743 in 1879, since which time they have not greatly increased, having been 835,100 in 1900. The power-looms, however, increased from 21,177 in 1880 to 32,245 in 1900. In 1899 there were 67,957 persons employed in the flax, hemp, and jute industries.

The manufacturing establishments are almost wholly centred in Ulster. The shirt-manufacturing industry has become very important in Londonderry County. Huguenots immigrating to Ireland after the revocation of the Edict of Nantes introduced the manufacture of silk, and for a time it enjoyed considerable prosperity, but it almost died out before the middle of the nineteenth century. In the early part of the nineteenth century a large number of factories changed from linen to cotton manufacture, and over 100,000 spindles were at one time used in the latter industry. But with the introduction of flax-spinning machinery the manufacture of cotton practically ceased.

Ship-building is a long-established industry, and became especially prominent during the last three or four decades of the nineteenth century. Belfast is the centre of the industry; the principal yard at this place employed 9000 men at the close of the century, and produced a larger annual tonnage than any other yard in the world. The whole fleet of the White Star Line, including the *Oceanic*, the *Celtic*, and the *Cedric*, were built at this yard. Ship-building on a small scale is carried on at Haulbowline, and has been recently revived at Londonderry and Dublin. In 1900, 21 steam vessels were built in Ireland, with a net tonnage of 94,666. The milling industry is steadily declining. The number of mills decreased from 1482 in 1891 to 1351 in 1901, and their average output also diminished. Importations of flour increased in amount during this time, and importations of wheat decreased. Prior to 1870 there was a thriving leather industry, but machine methods were not adopted, and it has become insignificant.

The home industries are still widely spread through Ireland, and, in the aggregate, contribute largely to the well-being of the people. Important among these home industries are hand knitting, hand embroidery, and lace-making.

The brewing and distilling branches have become the most important of the Irish industries, whether estimated with respect to the number of persons employed or the value of the product. The output of the distilleries increased from 4,801,000 gallons in 1861 to 14,221,520 in 1901. It has for a number of years exceeded in amount the output of English distilleries and equaled nearly one-half that of Scotland. The production of beer increased from 1,437,703 barrels in 1861 to 3,149,142 in 1901, the latter figure being less than one-tenth the total output of the United Kingdom for the same year, though greater than the amount consumed in Ireland. Irish beer is remarkable for its purity, being made almost exclusively from malt. The largest part of it consists of porter, which first became the popular drink between 1850 and 1860.

TRANSPORTATION. The railway system has been constructed, owned, and controlled by private capital. The system is peculiar on account of its large number of small lines, controlled by separate companies. In 1900 there were 17 principal railway companies and 32 subordinate companies. Since 1849 the main lines have had a uniform gauge. The total mileage increased from 1988 in 1871 to 3183 in 1900. The principal lines are the Great Southern and Western, the Midland Great Western, the Great Northern, and the Belfast and Northern Counties. The number of passengers carried increased from 15,547,934 in 1871 to 22,202,258 in 1891, and 27,649,815 in 1900. The tourist traffic is comparatively large, and receives special attention. Since 1889 a number of narrow-gauge railways, with a total of about 300 miles, have been constructed, most of which are in the western part of the island. Ireland has a number of canals and canalized rivers.

COMMERCE. Irish commerce is mainly with Great Britain, and consists of the exportation of raw products and the importation of manufactured articles. The exportation of live stock leads, and constantly increases as the pastoral industry grows in importance. In 1900 there were 745,519 head of cattle, 862,263 sheep, and 715,202 hogs shipped to Great Britain, as against 571,557 cattle, 577,626 sheep, and 382,995 hogs in 1881. Exports of fish are also important. The leading manufactured article exported is linen. It amounts to over £6,000,000 in value annually. Whiskies and beers are also shipped in considerable quantities. The exports to foreign countries and British possessions are quite small, having amounted, in 1900, to only £1,302,048. The imports from foreign countries and British possessions, however, are considerable, and are rapidly growing in importance. These consist largely of grains—corn and wheat—from the United States, and flax and tow from Belgium and Russia. The trade policy of Great Britain applies uniformly to Ireland. Only a few articles like tea, tobacco, and liquors are subject to import duties. For a discussion of the tariff duties, see *Finance*, under GREAT BRITAIN.

SHIPPING. The largest part of the trade of Ireland is through the ports of Belfast and Dublin. Belfast leads, both in the amount of foreign and of the total trade, the total tonnage clearing this port in 1900 having been 2,325,936, while the tonnage entering and clearing, excluding coastwise trade, was 685,750 tons for the same year. The foreign trade was 72 per cent. greater in 1900 than that for 1890. The foreign trade of Dublin decreased somewhat during the same period. The total tonnage clearing at the Dublin port in 1899 was 1,220,700. In 1900 the tonnage of vessels entering Irish ports with cargoes, engaged in British trade, was 6,325,173, and the tonnage clearing was 4,467,434, while the corresponding figures for the foreign trade were respectively 178,775 and 8316.

BANKS. Ireland has nine banks, all of which are joint-stock, and six of which are note-issuing. They have all adopted limited liability, except the Bank of Ireland, whose liability is undetermined. The authorized issue of notes may be exceeded if specie is held equal to the amount of the excess. The Bank of Ireland manages the public debt of Ireland free of charge. In 1865 the interest on advances to the Government was reduced to 3 per cent. In June, 1900, besides the nine banks there were 559 branch banks. The total capital reserve and undivided profits of these 568 institutions were £11,400,000, deposits and current accounts £47,700,000; loans and discounts, £36,600,000. The cash money at call and short notice was £9,900,000, and the circulation, £6,400,000.

SAVINGS BANKS. The establishment of trustee savings banks dates from the early part of the nineteenth century, and of post-office savings banks from 1861. The greater security afforded by the latter has made them much the more popular, and deposits in them have become over three times as great as in the trustee savings banks. According to the Savings-Bank Act of 1893, the maximum amount which each depositor might deposit in one year was raised from £30 to £50, and the annual maximum amount of stock which might be purchased was raised from £100 to £200; the stockholding limit was increased from £300 to £500. These changes resulted in a very large increase in the total deposits. In 1893 the trustee savings banks contained £1,380,718 deposits; in 1890, £2,035,000 and in 1901, £2,340-000. The deposits in the post-office savings banks increased from £663,000 in 1870 to £3,585,000 in 1890, and £8,289,000 in 1901. The number of open accounts in all savings banks increased from 177,628 in 1884 to 432,183 in 1900.

COÖPERATIVE CREDIT ASSOCIATIONS. The want of capital sufficient to secure an improvement of conditions in the poorer rural sections of the west and south of Ireland led to the establishment (1895) of coöperative credit associations upon the Raiffeisen system, through which money is loaned to persons needing it. In 1901 there had been 103 such 'banks' established.

GOVERNMENT. The chief executive officer for the government of Ireland is the Lord Lieutenant, who is assisted by a Privy Council. He is the personal representative of the Crown, and as such occupies a viceregal position, the maintenance of which is his chief function. For this purpose he receives a yearly allowance of £20,000. The actual conduct of the government devolves upon the Chief Secretary for Ireland, who is president of the Irish Local Government Board, a member of the House of Commons, and, when Irish affairs are prominent in the debates, is a member of the Cabinet, and as such is chiefly responsible to Parliament for the manner in which the government of the island is administered.

Since the Act of Union (1800) Ireland has been without a Parliament of its own, but is represented in the British House of Lords by twenty-eight temporal peers chosen by the whole body of Irish peers, and in the House of Commons by 103 commoners chosen by an electorate substantially the same as that by which English commoners are elected, namely, a household and lodger franchise. See GREAT BRITAIN.

The judicial system of Ireland is modeled upon that of England, and the Irish courts administer English municipal law. The chief judicial tribunal of the island is the Supreme Court of Judicature, which has two divisions—the High Court of Justice and the Court of Appeal. There are also a High Court of Admiralty, a Court of Bankruptcy, and a Land Commissioner's Court. The House of Lords is the final court of appeal from the decisions of the Irish courts. Minor offenses are tried by two justices of the peace.

Local government in Ireland has been revolutionized by the Irish Local Government Act of 1898, which undertook to collect, simplify, and adapt the mass of English and Irish legislation on the subject. Until then the chief county authority was the grand jury. By the act of 1898 this was replaced by a popularly elected council, chosen for a term of three years. The lower administrative units, boroughs and urban and rural districts, were likewise given elective councils. Affairs formerly attended to by grand juries and presentment sessions, such as relate to poor relief, highways, public health, and local institutions, are now administered by the councils. The larger cities were erected into 'county boroughs,' which are exempt from certain of the provisions of the Local Government Act.

Incorporated boroughs have a mayor, aldermen, and council, while those which are unincorporated are governed by commissioners. The borough councils have charge of such local matters as lighting, watching, sanitation, etc. The local councils are all subject to the supervisory authority of the Local Government Board, consisting of the Chief Secretary, the Under-Secretary, and four commissioners. It advises, directs, and controls the action of the councils in many particulars. It approves or rejects the appointment of officials nominated by the councils, fixes salaries, and regulates their term of service. The four commissioners of the board are appointed by the Lord Lieutenant and receive large salaries for their services.

FINANCE. The Imperial British system of finance is applied to Ireland in practically the same way as it is to the other parts of the Kingdom. In the union with Great Britain, Ireland became burdened with a share of the responsibility for a large national debt, which it had had no hand in making. The Irish generally maintain, and many financiers admit that the burden which the Imperial revenue inflicts upon the country is out of proportion to its wealth, and this claim constitutes one of the most serious grievances of the Irish Nationalists. According to the royal commissioners' report (1896) on the financial relations of Ireland to Great Britain, the taxable capacity of Ireland was only one-twentieth that of Great Britain or less, whereas the revenue collected was about one-eleventh of the amount raised in Great Britain. A comparison of Ireland with England and Wales shows that the per capita receipts from the income tax in the latter is about three times that in Ireland. Assuming that the income tax returns are a fair test of the relative financial capacities of the two countries, the injustice wrought by the indirect taxes is striking, since the per capita amount of these is only a little less in Ireland than in England and Wales. The proportion of the direct to the indirect taxes in England and Wales is as 48 to 52, whereas in Ireland it is as 27 to 63. The figures given below indicate the great importance of the excise duties. It is this item particularly that seems to be over-burdensome. A comparison with England and Wales for the fiscal year ending in March, 1899, shows that while the proof spirits consumed by those countries amounted to 4.60 gallons per capita, in Ireland it was only 2.85 per capita, while the duty per capita paid in England and Wales was 16*s.* 10*d.* against 14*s.* 10*d.* in Ireland. In other words, the varieties of spirits most consumed in Ireland are those upon which the highest rates are paid.

The following figures give the amount of the Imperial revenue collected in Ireland in the fiscal year ending in 1901: Customs, £2,798,000; excise, £3,364,000; estate, etc., duties, £732,000; stamps, £290,000; income tax, £975,000; post-office, £729,000; telegraphs, £174,000; Crown lands, £33,000; miscellaneous, £116,000; and a local taxation revenue amounting to £294,000. The Imperial expenditures in Ireland for the same year were: Civil government, £4,545,000; collection of taxes, £244,000; post-office, £1,061,000; paid to local taxation accounts, £1,054,000; "from local taxation revenue," £402,000. The taxes on real property are the principal source of local revenue. In the fiscal year 1898-99 the local receipts were as follows: Rates, water, gas, and electric light, £3,234,011; tolls, dues, etc., £491,166; rents, interest, etc., £126,304; Government contributions, £475,384; loans, £592,303; and miscellaneous, £322,874. The principal branches of local expenditures for the same year were: Town and municipal authorities, for police, sanitary works, etc., £1,597,968; unions and parishes for poor relief, £1,135,334; county, rural, sanitary, and road authorities, £1,550,599; harbor authorities, £577,968.

Population. Owing to its insularity and its position on the extreme outskirts of Europe, Ireland received only the ebb-flow of the great European migrations, and its population is therefore relatively simple in composition. Three major types are usually recognized. The most primitive is a short black-haired, brown-skinned, dolichocephalic race, sometimes called Firbolg in accordance with Irish tradition, which has been variously defined by anthropologists as Neolithic and non-Aryan, or again as Iberian or a branch of the Mediterranean race. The conquerors of this people were a tall and blond race known in Irish traditions as the Tuatha-de-Danaan. It is not known whether the Tuatha-de-Danaan were a Scandinavian or Celtic-speaking people. They were followed by the Gaelic invasion, probably within historic times—a Celtic-speaking race identified with the predominant Irish type of the present day. Stature and cephalic index in Ireland to-day vary little from the characteristic type of England and Scotland, and the Irish people is discriminated from the English and Scotch mainly on grounds of pigmentation (as among the so-called "black Irish"), language, and temperament. Not taking into consideration the different early immigrants, such as the Scandinavians and the Anglo-Normans, which were largely assimilated with the original stock, there are to-day three fairly distinct racial elements represented in Ireland, a fact which is responsible in a measure for the social and political troubles which have long disturbed the country. By expulsion and by extermination, the population had been considerably reduced by the end of Cromwell's reign, when the number was estimated at but a little over half a million. The depopulated districts of Eastern and Northern Ireland were repeopled by settlers from England and Scotland, respectively, and the English became the landowners throughout the other portions of the island. Until after the middle of the eighteenth century the population grew but slowly, being not infrequently checked by the ravages of famine. But toward the end of that century different causes conspired to bring about a rapid increase in the population. Chief of these was probably the universal adaptation of the potato as the main staple of food, the plant giving more returns for the amount of area and labor devoted to it than other plants, and being well suited to the needs of the people. Connected with this was the increased impetus given to industry in general during the wars with France, and also the decided tendency which developed at this time toward the division of the land into leaseholds, making the acquisition of a holding easy. Under these influences marriages were entered into early and families were large. Whereas, in 1785, estimates place the population at less than 3,000,000, in 1821 the first official census records the population at 6,800,000, and the census of 1841 showed a population of 8,196,000. Considering that the population was almost wholly rural in composition, it was much in excess of that which a healthy economic and social status would permit.

The sequel was precipitated by the potato blight in 1845. This resulted in a large number of deaths from starvation and disease, but its greatest significance was the starting of the tide of emigration which has continued to depopulate the island to the present time. Prior to the Revolution in the American colonies the Scotch-Irish element of Northern Ireland had found its way to the colonies in large numbers, but not until the time of the famine did the movement affect the Celtic element. It is estimated that in round numbers there were two million Irish emigrants between 1840 and 1860, and one million in each of the following twenty-year periods, most of whom went to the United

States. In the aggregate, the male emigrants exceed in number the female, though the contrary is true for the Province of Connaught. During the year 1900 the emigrants leaving Ireland numbered 45,300. The births usually exceed the deaths by 22,000 or 23,000 annually. The following table gives the population by provinces for each decade since 1841 and the per cent. of decrease of each for the last decade:

POPULATION FROM 1841 TO 1901

PROVINCES	1841	1851	1861	1871	1881	1891	1901	Per cent.
Leinster	1,982,000	1,682,000	1,457,000	1,339,000	1,279,000	1,192,000	1,150,000	3.5
Munster	2,404,000	1,860,000	1,513,000	1,393,000	1,331,000	1,174,000	1,075,000	8.4
Ulster	2,389,000	2,014,000	1,914,000	1,833,000	1,743,000	1,620,000	1,581,000	2.4
Connaught	1,421,000	1,012,000	913,000	846,000	822,000	719,000	650,000	9.7

In 1901 there were 2,197,739 males and 2,258.807 females. It will be seen that Munster and Connaught have each declined much more than one-half during the period, and the rate of decrease still continues high in those provinces.

The average population per square mile is 140, or less than one-fourth that of England, and about equal to that of the State of New York. The loss of population has been at the expense of the rural districts, the urban population having held its own. The following table shows the population of cities above 25,000 for 1891 and 1901:

CITIES	1891	1901
Belfast	255,950	349,180
Dublin	245,001	290,638
Cork	75,345	76,122
Londonderry	33,200	39,892
Limerick	37,155	38,151
Rathmines and Rathgar*	27,796	32,602
Waterford	20,852	26,769
Pembroke*	23,992	25,799

* Dublin suburbs.

While the density of population is no longer excessive, even for a country largely agricultural, a large number are scarcely able to secure a livelihood. Certain regions are known as 'congested districts,' and a special board has been created to aid the people and improve the conditions in such districts. The explanation lies in the fact that the tenants have been evicted from the more fertile regions (see *Agriculture*) and have segregated in the less fertile broken regions, especially in the western Province of Connaught, where the small holding of the peasant does not afford sufficient livelihood for the family, and large numbers are annually obliged to leave their homes during the harvest months and supplement their income by labor in the harvest fields of Scotland and England. The landowning class, or the old aristocracy throughout Ireland, as also the greater part of the well-to-do trading and professional classes, belong to the English element. In Ulster a part of this class belongs to the Scotch element, but a majority of the Scotch are artisans or cotters, whose economic standard of life is somewhat higher than that of the Celtic element, the latter belonging almost entirely to the peasant and the laboring classes. According to the census of 1901, there were 131,035 persons belonging to the professional class, 219,418 to the domestic class, 97,889 to the commercial class, 876,062 to the agricultural class, 639,413 to the industrial class, and 2,494,954, mainly children, to the indefinite and non-productive class.

The Irish language was almost universally used in the rural districts by the Celtic element until about 1835. Considering the resentment which the Celtic element has always held toward the British, the general change from the Irish to the English language was remarkable for the little opposition that was made to it, and the rapidity with which it was accomplished. In 1881 18.2 per cent. of the population could speak Irish; in 1891 only 14.5 per cent. (680,245). The percentage is naturally greatest in Connaught and Munster, where the percentages in 1891 were 37.8 and 26.2, respectively (over half of the population of Galway and Mayo were able to speak Irish), while in Ulster the percentage was only 5.2, and in Leinster 1.2. In 1891 only 38,192 persons were reported who spoke Irish only. In very recent years a movement has been started to popularize the Irish language again. In the last decade of the nineteenth century the number who were able to speak the Irish language decreased for the country as a whole, though the number almost doubled in Leinster, and increased also in Ulster.

RELIGION. That the religious denominations in Ireland correspond very closely to the different racial elements explains in part the social friction which exists in the country. The Celtic Catholic Church resisted from the first the attempts of the English to break its connection with Rome and impose upon it the changes which had accompanied the religious revolt in England. The property of the Church of course continued in the hands of the Church that represented the Government. The Catholics were placed under serious disabilities, not being allowed to teach school, or to act as guardians. Priests were obliged to remain in their own parishes, and were excluded from public affairs. Tithes were exacted from the Catholics for the support of the Established Church. The disabilities were not removed until 1829. The tithes were commuted in 1838. When the political union with England was effected in 1800-01 there was also a union between the established churches of the two countries. The union was dissolved and the Irish Church disestablished by an act of Parliament which went into operation in 1871. The act provided for the surrender of the property and revenue of the Church with the exception of private endowments. Since then the government of the Church of Ireland is in the hands of a General Synod which meets annually. There are also twenty-three diocesan synods. There are two archbishops and eleven bishops.

It will be seen from the table below that about three-fifths of the Episcopalians are concentrated in the Province of Ulster, and the greater part of the remainder are in Leinster. The Scotch who settled in Ulster were mostly Presbyterians. More recently Methodism has secured a hold among them. Presbyterianism was proscribed during the reign of Queen Anne, but with this exception was generally tolerated by the Government, and until the disestablishment of the Epis-

Episcopal Church received a small annual bounty. The Church has 5 synods, 36 presbyteries, and 572 churches.

The following table shows the relative strength of the four leading denominations in the different provinces and the tendency of each for the last forty years of the nineteenth century. It will be seen that even in Ulster the Catholic Church outnumbers any of the others, and in the provinces of Munster and Connaught the non-Catholic elements constitute but a very small fraction of the population. The extreme northeast counties of Londonderry, Down, Armagh, and Antrim have a larger non-Catholic than Catholic population.

PROVINCES	Year	Catholic	Episcopalian	Presbyterian	Methodist
Leinster	1861	1,252,500	180,500	12,300	6,290
	1901	981,000	141,000	11,735	7,650
Munster	1861	1,420,000	80,800	4,000	4,430
	1901	1,007,200	55,900	3,300	4,770
Ulster.........	1861	966,600	391,300	503,800	32,000
	1901	699,000	359,900	426,170	47,100
Connaught.....	1861	666,000	40,600	3,088	2,640
	1901	622,600	22,400	2,270	1,650
Total	1861	4,305,100	693,200	523,188	45,360
Total........	1901	3,309.800	579,200	443,475	61.170

The Methodists are the only sect that did not show a decrease during the period, while the percentage of loss was greatest for the Catholics. In the last decade of the century the Catholics lost 6.7 per cent. of their membership, the Episcopalians 3.5 per cent., the Presbyterians 0.3 per cent., and the Methodists increased 10.4 per cent. The greater decrease of the Catholic population is due to the fact that the Catholics emigrate in larger numbers than the Protestants. See table under *Population*.

EDUCATION. In the establishment of an educational system in Ireland, as in many other countries, religion has been a seriously disturbing factor. Such educational advantages as were offered the Irish children by the Government were thoroughly dominated by the idea of making them Protestants and essentially British, and consequently these advantages were shunned by all Catholics. At the same time laws passed in the reigns of William III. and Queen Anne made it a penal offense for Catholics to teach or to send their children abroad to be educated. Catholic teaching, however, was carried on in violation of the law, such schools being known as 'hedge schools.' A great deal of money from both private and Government sources was expended on education during the eighteenth century and the early part of the nineteenth, most of it being expended through the proselyting societies. The Charter Schools, founded in 1733, and the Association for the Prevention of Vice, founded in 1800, received Government grants, while the London Hibernian Society, founded in 1805, and the Baptist Society, established in 1814, were supported mainly from subscriptions. The Erasmus Smith schools, dating from 1657, were endowed. A Catholic congregation—the Christian Brothers—was founded in 1802 for the purpose of teaching, and later attained considerable importance. In 1811 the Kildare Place Society was founded, and after 1814 received Government subsidies. This society introduced the policy of limiting religious instruction to Bible-reading.

In 1819 the Government began to make grants to schools established by voluntary subscriptions without regard to religion. In 1831-34 the so-called National System of education was established. Under this system secular instruction was given to children assembled together without distinction of creed, but it was provided that they should be separated for purposes of religious instruction, which should be given by the pastors of the respective local churches. At first the Catholics took kindly to the system, the Episcopalians and Presbyterians being opposed to it. However, concessions were made to the Protestants, and a proselyting spirit was allowed to creep into the secular teaching. The Catholics were unable to prevent this, owing to their small representation on the board of commissioners in charge; while the Church condemned it, demanding (1850) separate education, and forbidding Catholic children from attending Protestant instruction. In 1861 the Catholic membership upon the board was made equal to the Protestant. At present the system is divided for the most part along denominational lines. The children of the different religious faiths generally go to schools taught by teachers of their own faith. In 1899 the Protestant pupils in schools taught by Catholic teachers numbered only 5.3 per cent. of the total in attendance, and only 9.8 per cent. of the pupils in schools under Protestant teachers were Catholics. A comparatively small number of schools were taught by both Catholic and Protestant teachers, and the attendance at these was more evenly divided between the different religious faiths. No child is allowed to attend a religious exercise of a denomination other than his own except upon the written request of the parent.

The Irish educational system differs radically from the English, in that the former is so completely under the control of the central administration. The regulating of teachers' salaries, determining the course of instructions, furnishing schools with supplies, including books, and even the erecting of a certain class of buildings, are all matters in the hands of the central board. The provision of text-books by the State follows from its policy of not allowing religious questions to be raised in secular teaching, and from the desire to prevent the fostering of sentiments out of harmony with Imperial unity. The omission of Irish patriotic songs and of Irish history naturally subjects the administration to much criticism. The supervision of the system is secured by dividing the country into districts and assigning an inspector and corps of subinspectors to each division.

Since 1892 there has been a compulsory school law, the compulsory period being from six to fourteen. The law is, however, not well enforced. Illiteracy is decreasing throughout the country, the per cent. of persons five years and over who could neither read nor write having decreased from 25.2 in 1881 to 18.4 in 1891, and to 13.7 in 1901. Illiteracy is much the most prevalent in Connaught, where in the last year it amounted to 20.7. The per cent. among the Catholics was over twice as great as for any of the Protestant sects. In December, 1900, there was a total of 8684 schools, attended by 550,520 Roman Catholic pupils, 88,675 Protestant Episcopal pupils, and 97,666 others, mostly Ulster Presbyterians. In the preceding year only 64.5 per cent. of the enrollment was in average attendance. No special provision is made by the Government for secondary schools other than certain grants in aid which are distributed without regard to the auspices under which they are conducted, according to the 'payment in result' system. There are one national and four denominational training-schools for teachers, all of which are aided by the Government. The students in these schools receive a part of their training in 'model schools,' of which there were thirty in 1899.

About 94 per cent. of the annual expenditure for schools is borne by the State. The system of apportioning the State grant to elementary instruction according to the results of an examination given the pupils was only recently abandoned. The grant is now based upon average attendance, with the teacher's salary additional, the salary being fixed according to the one of the three grades in which he teaches, though it may be raised within any given grade for 'continued good service.'

The principal higher institution of instruction is the University of Trinity College, Dublin, which had an enrollment in 1900 of 1100 students. The Catholic population have refused to patronize this institution, and have sought in vain to secure State maintenance for a Catholic university. The University College in Saint Stephen's Green, Dublin, is under the direction of the Jesuits. There is a National University which only exercises, in the main, examining functions, and a large number of Catholics receive degrees from this institution. Of the three Queen's colleges, at Belfast, Cork, and Galway, respectively, only the first is of true university rank. The Presbyterians maintain the McGee College at Londonderry. There are also a number of technical and theological institutions. Alexandra College is for the education of women, and members of that sex are admitted also to the Queen's colleges.

CHARITIES. The poor-law system is similar to that described under title GREAT BRITAIN for England and Wales. The adult able-bodied indoor paupers in 1901 numbered 4947, and all other indoor paupers numbered 36,934. The outdoor paupers for the same year numbered 57,575, and the number of inmates of asylums was 1452. Much was done during the last decade of the nineteenth century to improve the conditions of the districts which had long suffered from poverty. A law of 1821 declared that when the population of an electoral division exceeded a certain ratio to the ratable value of its property it should be known as a congested districts county. These districts are wholly in Western Ireland—principally in Connaught and in the counties of Donegal and Kerry. A Congested Districts Board was established and means was made accessible for this board's use in the betterment of conditions in these districts. The system of cultivation practiced in them was found to be most deplorable, and it was generally necessary for the occupants of the holdings to have a secondary source of income, as, for instance, harvest migrations to Scotland and England, as already mentioned. Agricultural inspectors were employed by the board, and much has been done toward improving the soil and the methods of cultivation. Sometimes families are removed to more favorable localities, and not infrequently a number of small holdings are amalgamated into one sufficiently large to maintain a family. The board has done much also to aid in the development of the coast fisheries.

HISTORY. According to native legends Ireland was inhabited first by various tribes, of which the most important were Nemedians, Firbolgs, and Danaan, who were eventually subdued by Milesians or Scots. Although Ireland is mentioned under the name of Ierne in a Greek poem five centuries before Christ, and by the names of *Hibernia* and *Juverna* in various Roman writers, little is known with certainty of its inhabitants before the fourth century after Christ, when, under the appellation of *Scoti*, they became formidable by their descents upon the Roman Province of Britain. These expeditions were continued, and extended to the coasts of Gaul, till the time of Loegaire MacNeill (c.430), in whose reign Saint Patrick (q.v.) attempted the conversion of the natives. Although Christianity had been previously introduced in some parts of Ireland, Patrick encountered great obstacles, and the new faith was not fully established in the island till about a century after his death.

From the earliest period each province of Ireland appears to have had its own king, subject to the *ard-ri* or monarch, to whom the central district, called Meath, was allotted, and who usually resided at Tara. Each clan was governed by a chief selected from its most important family. The laws were dispensed by professional jurists styled *brehons*, who received great consideration, and were endowed with lands and important privileges.

In the sixth century extensive monasteries were founded in Ireland, in which religion and learning were zealously cultivated. From these establishments numerous missionaries went forth during the succeeding centuries, while many students of distinction from England and the Continent visited Ireland and received instruction at this period. The progress of Irish civilization was checked by the incursions of the Scandinavians, commencing toward the close of the eighth century, and continued for upward of two hundred years. Establishing themselves in towns on the eastern coast of Ireland, with the assistance of friendly native tribes, they continued to make expeditions into the interior until their signal overthrow at the battle of Clontarf, near Dublin, in 1014, by Brian, surnamed Boroimhe.

The first step toward an Anglo-Norman conquest of Ireland was made by Henry II., who is said to have obtained in 1155 a bull from Pope Hadrian IV. authorizing him to take possession of the island, on condition of paying to the Papal treasury a stipulated annual revenue. Political circumstances prevented Henry from entering upon the undertaking until 1167, when Dermod Macmurrough, the deposed King of Leinster, sought refuge at his Court and obtained permission to enlist the services of English subjects for the recovery of his kingdom. Dermod, returning to Ireland in 1169, with the aid of his foreign mercenaries and still more numerous Irish allies, succeeded in recovering part of his former territories and in capturing Dublin and other towns on the eastern coast. After his death, in 1171, the succession to the Kingdom of Leinster was claimed by his son-in-law, Richard Fitz Gislebert, Earl of Pembroke, surnamed 'Strongbow.' In the following year King Henry, with a formidable armament, visited Ireland, received homage from several minor native chiefs and from the principal Norman leaders, and granted to the latter charters authorizing them, as his subjects, to take possession of portions of the island, in virtue of the grant made to him by the Pope. The chief Anglo-Norman adventurers, Fitz Gislebert, De Cogan, De Lacy, Fitzgerald, Fitzstephen, Fitzmaurice, and De Courcy, encountered formidable opposition before they succeeded in establishing themselves on the lands which they thus claimed. The government was intrusted to a viceroy, and the Norman legal system was introduced into such parts of the island as were reduced to obedience to England. The youthful Prince John was sent by King Henry into Ireland in 1185; but the injudicious conduct of his council excited disturbances, and he was soon recalled to England. John made an expedition into Ireland in 1210, to curb the refractory spirit of his barons, who had become formidable through their alliance with the natives. During the thirteenth century the principal Anglo-Norman adventurers succeeded in establishing themselves, with the feudal institutions of their nation, in some parts of Ireland, by the assistance or suppression of native clans. The Fitzgeralds, or Geraldines, acquired almost unbounded power in Kildare and East Munster, or Desmond; the Le Botillers, or Butlers, in Ormond, or West Munster; and the De Burghs, or Burkes, in Connaught. After the battle of Bannockburn, in 1314, Edward Bruce invaded Ireland and attempted to overthrow the English power there. The Pope, at the instigation of England, excommunicated Bruce with his Irish allies; but although his enterprise failed of success, the general result was a decline of the English dominion in Ireland. The descendants of the most powerful settlers gradually became identified with the natives, whose language, habits, and laws they adopted to so great an extent that the Anglo-Irish Parliament passed, in 1366, the 'Statute of Kilkenny,' decreeing excommunication and heavy penalties against all those who followed the customs of, or allied themselves with, the native Irish. This statute, however, remained inoperative; and although Richard II., later in the fourteenth century, made expeditions into Ireland with large forces, he failed to effect any practical result, and the power and influence of the natives increased so much at the time of the War of the Roses that the authority of the English Crown became limited to a few towns on the coast and the district termed the Pale (see ENGLISH PALE), comprising a small circuit about Dublin and Drogheda. In the struggle between the houses of York and Lancaster Ireland supported the House of York.

The participation of the Anglo-Norman nobility of the Pale in the War of the Roses greatly crippled the English interest. When he came to the throne, Henry VII. left Gerald, Earl of Kildare, Viceroy of Ireland, although the Earl belonged to the Yorkist party. The assistance rendered by the Earl to the Yorkist pretenders finally compelled the King, in 1494, to remove him and to send over Edward Poynings to restore order to the Pale. Poynings represented the purely English interest, as distinct from the Anglo-Norman interest, which up to that time had prevailed in Ireland. He at once summoned the Parliament of Drogheda, which enacted most important legislation, providing for the defense of the Pale, reducing the power of the Anglo-Irish lords, and rendering the Parliament and judiciary of Ireland dependent on the English Crown. The nobility was forbidden to oppress the inferior baronage, to make exactions upon the tenantry, or to assemble their armed retainers; their influence on the towns was diminished. The Statute of Kilkenny, which compelled the English and Irish to live apart, and forbade Irish law and customs in the Pale, was confirmed. All State offices, including the judgeships, were filled by the King, instead of the viceroys, and the entire English law was to hold for the Pale. Most important of all was the so-called Poynings Law, which made the Irish Parliament dependent upon the King. It provided that all proposed legislation should first be announced to the King and meet with his approval, after which the King should issue the license to hold Parliament.

Henry VII. reëstablished the Earl of Kildare, who was the most powerful of the Irish nobility, as Viceroy, and under his rule the Pale grew and prospered. His family, the famous Geraldines, rebelled and were overthrown during the reign of Henry VIII. In 1531 Henry VIII. assembled a Parliament at Dublin which introduced the Reformation into Ireland. The King was declared head of the Church, which was separated from Rome, and the dissolution of the monasteries was begun. Somewhat later relics and images were destroyed and the dissolution was completed. The native chieftains were conciliated by a share of the spoils and received English titles, their lands being regranted under English tenure. It was Henry's policy thus to conciliate them and to leave the Irish under their own laws. An English commission held courts all over the island, but Irish right was respected and the country remained peaceful. This result came about under the wise rule of Saint Leger, who was Viceroy during the latter part of the reign. In the Parliament of 1541, attended for the first time by native chieftains as well as the lords of the Pale, Henry's title of Lord of Ireland, which had been conferred by the Pope, was changed into that of King.

The religious changes under Edward VI. and Mary had little effect upon Ireland. Although Mary was herself a Catholic, she was the first to begin the colonization of Ireland by English settlers. The Irish people of Kings and Queens County were driven out and their lands given to English colonists. Elizabeth at first followed her father's policy of conciliating the Irish chieftains, but the rebellion of Shayne O'Neill, an Ulster chief, caused a radical change in her policy. An act was passed making all Ireland shireland, and the commissioners of justice were invested with military powers. So far from respecting Irish right, they ignored it altogether. The religious wars of Elizabeth were attended by rebellions of the Irish Catholics. The Earl of Desmond, a representative of the great House of Geraldine, which ruled over the greater part of Munster, was defeated after a long struggle. Hugh O'Neill, called by the English the Earl of Tyrone, annihilated an English army on the Blackwater, and baffled the Earl of Essex, whom Elizabeth had sent against him. A Spanish force coming to his assistance made the mistake of landing in the south, instead of in the north, as had been promised, which led O'Neill to make a march of 200 miles through desolate country in order to join them. His forces were too weak to withstand the English in the field, and about the beginning of 1603 he submitted to Lord Mountjoy, but was allowed to retain his earldom. During all these wars the greatest cruelty and treachery were practiced on both sides. In order to destroy Irish resistance, the English devastated the villages, crops, and cattle, putting to death all the inhabitants they could secure. The greater part of Munster and Ulster was laid desolate, and many more perished from hunger than by the sword.

Under Elizabeth and James I. the Anglican State Church was extended over Ireland, not only obtaining all that belonged to the Church of the Pale, but being invested with the establishment belonging to the Celtic Church as well. There was an ancient feud between these two Irish churches, and they were intensely hostile to each other. The Church of the Pale was effected by the Reformation, but the Celtic Church became increasingly Roman. The entire Celtic population of Ireland, and the majority of the inhabitants of the Pale, remained Catholic. The Anglican Church thus became a mere instrument in the hands of the English rulers in Dublin Castle.

During the reign of James I. the English system was introduced into Ireland on a grand scale. English law was pronounced the sole law of the land. The fight of Tyrone and Tyrconnell gave a pretext for the confiscation of the land in six counties of Ulster. The independence of the Irish Parliament was destroyed by the creation of forty boroughs out of small hamlets, which secured a permanent majority to the Crown.

The despotism of the Earl of Strafford, the Viceroy of Charles I., produced order and prosperity in Ireland. By balancing the number of Catholics and Protestants in Parliament and holding out to the former the promise of toleration, he succeeded in obtaining liberal supplies for the King in his conflict with the English Parliament. The native Irish, who had been dispossessed by the plantations in Ulster and elsewhere, made use of the English situation to regain their possessions. Under the leadership of Roger O'Moore, a conspiracy was formed in 1641 to seize Dublin and expel the English. They succeeded in driving the English settlers out of Ulster, and committed many outrages; not, however, so many as has been supposed. It has been estimated by English writers that at least 30,000 people were put to death, but this number is certainly exaggerated. The Scotch were, as a rule, spared. The insurgents were soon joined by the Catholic lords of the Pale, and together they chose a Supreme Council to govern Ireland. Charles I. sent over the Earl of Glamorgan to treat with them, and the Earl went so far as to promise them the predominancy of the Catholic Church in Ireland as the price of their assistance to the King. But the struggle in England was terminated in favor of the Parliament before the Irish Catholics could render effective assistance to the King. In 1647 the alliance between the lords of the Pale, who desired nothing beyond toleration for their religion, and the Celts, who hoped for the restoration of the ancient land system, came to an end. In 1648 the Earl of Ormond returned as the Viceroy of Charles I., and made an alliance with the Catholic lords, thus securing Ireland to the Royalist party. In 1649 Cromwell landed at Dublin, which the Catholics had been unable to take. With his well-disciplined army, 10,000 men of the New Model, he stormed Drogheda and put its garrison of 2000 to the sword. At Wexford there was another slaughter, but without Cromwell's orders. His successors, Ireton and Ludlow, finished the war, and a great part of the best lands of Munster, Leinster, and Ulster was confiscated and divided among the soldiers of the Parliamentary Army. The Catholics and Loyalist landowners were banished to Connaught. A portion of the land confiscated at this time was restored under Charles II., but at least two-thirds of the land in Ireland remained in the hands of the Protestants. The viceroyalty of Ormond did much to restore order and promote industry, but the Protestant ascendency was maintained. James II., however, reversed this policy. Under his viceroy, the Earl of Tyrconnell, Catholics were advanced to positions of State and placed in control of the militia, which Ormond had previously organized. Consequently, the entire Catholic population took sides with James II. in the English Revolution of 1688, and when in 1689 James landed at Dublin with his French officers, Tyrconnell had an Irish army ready to assist him. The Protestant settlers were driven from their homes and found refuge in Enniskillen and Londonderry. James attempted to capture Londonderry, but he was hampered by the lack of artillery and the city was relieved by way of the sea. His Parliament of 1689 restored all the lands that had been confiscated since 1641, and passed an act of attainder against the partisans of William III. In the following year William landed in Ireland, and in the battle of the Boyne (July, 1690) defeated the Irish forces. He failed, however, to capture Limerick, which was bravely defended. A brilliant sally of the Irish patriot Sarsfield destroyed William's heavy artillery, and he was forced to retire. The next year his generals defeated the Irish Army at Aughrim, and Limerick was forced to capitulate. By the terms of the Treaty of Limerick, Catholics were permitted a certain amount of religious freedom, and the lands they had possessed under Charles II. were to be restored.

The Parliament of England forced William to break the concession of the Treaty of Limerick, regarding the restoration of the lands, and the Parliament of Ireland violated the terms granting religious toleration by enacting the penal laws, directed mainly against the Roman Catholics. The peasants were annoyed by cruel and vexatious restrictions alike on their religious worship and innocent amusements. An act passed under George I. made all laws enacted by the British Parliament extend over Ireland. Her commerce and industries were deliberately crushed. In 1663, and again in 1696, all Irish trade with the English colonies was prohibited, and in 1665 and 1680 the Irish import trade to England in cattle, milk, butter, and cheese was forbidden. The trade in woolens, which had grown up among the Irish Protestants, was likewise crushed by an enactment of 1699, which prohibited the export of woolen goods from Ireland to any country whatever. Small amends for these injuries were made by leaving the linen trade undisturbed. The result of all these measures was the gradual decline of Ireland. A large percentage of the best elements of the population emigrated—the Catholics to serve in the armies of Spain and France, the Protestants to carry their industries to America.

The American Revolution awakened much sympathy in Ulster, especially among the Presbyterians, who, being disqualified from holding office, desired a general emancipation, including the Catholics. In 1778 the Irish Parliament passed the Relief Act, removing some of the most oppressive disabilities. Meanwhile, the Irish Protestants, under pretext of defending the country from the French, who had formed an alliance with the Americans, had formed associations of volunteers, 80,000 strong. Backed by this military force, they, under the lead of Grattan, demanded legislative independence for Ireland, and on motion of the younger Fox the British Parliament repealed both the Poynings law and the act of George I. mentioned above. But the Irish Parliament was composed entirely of the Protestants of the Established Church, who were unwilling to extend the suffrage, and it was even more corrupt and in need of reform than the British Parliament. The principles of the French Revolution found their most powerful expression in Ireland in the Society of United Irishmen, which organized the rebellion of 1798. The peasantry rose in Wexford, and, although miserably armed, made a brave fight. At one time Dublin was in danger, but the insurgents were defeated by the regular forces at Vinegar Hill. A French force of 1100 landed in Killala Bay, but too late to render effective assistance. A reign of terror ensued, of which even the English Governor disapproved. Pitt, the British Prime Minister, thought a legislative union of the two countries, together with Catholic emancipation, the only remedy for Catholic rebellion and Protestant tyranny. By a lavish use of money and distribution of patronage, he accordingly induced the Irish Parliament to pass the Act of Union. On January 1, 1801, the Union was formally proclaimed.

The history of Ireland since the Union is the story of a continuous struggle for civic and religious freedom, and for separation from Great Britain. Hardly had the Union been carried out when the universal dissatisfaction gave rise to the outbreak of July 23, 1803, under Robert Emmet (q.v.). It was easily suppressed, and for some time there were no further armed revolts. Instead a conflict was carried on along Parliamentary lines under the leadership of Daniel O'Connell (q.v.). In 1823 he founded the Catholic Association, which demanded first of all Catholic emancipation. This was finally obtained, for in 1828 Catholics were permitted to hold office, and in 1829 they were allowed to sit in Parliament. The struggle now turned upon the tithes, which all, Catholics included, were compelled to pay for the maintenance of the Anglican Church in Ireland. Great cruelties were perpetrated on both sides during the so-called 'Tithe War,' which about 1831 became coupled with a renewed emphatic demand for the repeal of the Act of Union. O'Connell formed various societies to carry on the agitation, and there was considerable lawlessness, which was fostered by the so-called Ribbon Society (see RIBBONISM).

The reform of Parliament in 1832 aided the Irish leaders, for it increased the number of Irish members from 100 to 105, and, more important still, it gave the middle class more power, in place of the pro-English aristocracy. In 1838 a bill was passed converting the tithes into rent-charge, to be paid by the landlords, and agitation in connection with the Church ceased to be acute for a time. O'Connell had for a long period been supported by the more extreme of the Irish Nationalists, but in 1843 it became evident that he would never make an appeal to arms. The consequence was the formation of the Young Ireland Party, whose leaders were all young men, the most notable being William Smith O'Brien, John Blake Dillon, Thomas Francis Meagher, and John Mitchel. The last-named in turn seceded from the Young Ireland Party, and advocated an Irish republic. For a while Peel, the English Prime Minister, tried concessions, but in vain, the more so as from 1845 to 1847 rent-racked Ireland suffered from a terrible famine, due to the failure of the potato crop. Vast numbers emigrated, especially to America, whither they carried with them the hatred toward England, and continued to give effective support to the Irish cause. Many also died, and it is said that in all one and a half million of people had disappeared by 1848. In the latter year the Young Ireland Party sought to bring about a revolt, but the whole attempt proved a miserable failure; the leaders were captured and transported.

The work of the Young Ireland Party was in time taken up by the Fenian Society (q.v.), which accomplished nothing, except arousing English feeling by various outrages, and thus giving rise to several coercive measures. Far-reaching reforms, however, came about through the efforts of Gladstone. On July 26, 1869, a measure was passed by Parliament, which finally disestablished the Irish Church, the act taking effect on January 1, 1871. (See IRELAND, CHURCH OF.) Many reforms in the land laws were also carried out, which are described in detail under IRISH LAND LAWS; while the agrarian agitation is treated under LAND LEAGUE. Ireland, however, was not content with ecclesiastical and agrarian reforms, and Home Rule (q.v.) became the all-absorbing question, the cause finding a champion of great ability in Charles Stewart Parnell (q.v.). In 1880 the agrarian movement in Ireland developed into a system of organized terrorism. As a result of this lawlessness a bill became law on March 2, 1881, known as the Coercion Act, which gave the Lord Lieutenant of Ireland power, by warrant, to arrest any person, on mere suspicion, for treason, intimidation, and the like. Under this law Parnell and other Irish leaders were arrested, but, as usual, the Irish retaliated with outrages, which culminated in the murder of the Chief Secretary for Ireland, Lord Frederick Cavendish, and the permanent Under-Secretary, Thomas H. Burke, in Phœnix Park, Dublin, on May 6, 1882. Thereupon the Government passed an exceptionally stringent and severe Crimes Act, which, among other things, permitted the examination of witnesses without bringing any specific charges against individuals. By this means a body, known as the 'Invincibles' (q.v.), was discovered, under whose auspices most of the outrages had been perpetrated.

But both the Liberals and Conservatives in England ultimately recognized that existing conditions could not continue. At first the Conservative Party negotiated with the Irish Nationalists. On August 14, 1885, the exceptional laws were allowed to lapse by the Conservative Ministry. In April, 1886, Gladstone, the great Liberal leader, proclaimed the right of Ireland to Home Rule by introducing his bill in Parliament. The Irish question had passed into a wholly new phase, which has been treated under the various separate articles referred to above.

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IRELAND, CHURCH OF. The name applied to the independent branch in Ireland of the Anglican communion. It was established by law according to the Act of Union, which went into effect on January 1, 1801. The Established Church of Ireland, considering itself the rightful successor of the mediæval Roman Catholic Church, took possession of the dioceses, parishes, and Church property, and for a long time retained the divisions then existing. The Roman Catholics, constituting a large majority (more than three-fourths) of the population, always regarded as unjust the existence, in their country, of an Established Protestant Church in connection with that of England. Notwithstanding its small membership, the Church had, in 1833, 4 archbishoprics, 18 bishoprics, the income from which was estimated at from £130,000 to £185,000. In that year the first inroad was made upon the prerogatives of the Established Church in the reduction of the archbishoprics to two and the bishoprics to ten. In 1868, on motion of Gladstone, the English House of Commons voted to disestablish the Church of Ireland. The House of Lords rejected the proposition. But so strong was the expression of public opinion against the continuance of the privileges of the Irish Church that the royal commissioners on the revenues and conditions of the Church of Ireland recommended in their report, July 27, 1868, important reductions as to its benefices. They suggested, among other changes, the abolition of four bishoprics and one archbishopric, and that all benefices with less than forty Protestants should be suppressed. Gladstone introduced, in March, 1869, a new bill for the disestablishment and disendowment of the Irish Church, which, after a long and earnest debate, passed both Houses of Parliament. The disestablishment was to be total; ecclesiastical courts and laws were to cease; the bishops were to be no longer peers in Parliament; the ecclesiastical commission was to terminate, and a new commission of Church temporalities, composed of ten men, was to be appointed, in which the whole property of the Irish Church should be vested. Public endowments, including State grants or revenues (valued at £15,500,000), were to be retained by the State, and private endowments, such as money given from private sources since 1660 (estimated at £500,000), were to remain with the disestablished Church. The vested interests connected with Maynooth College, with the Presbyterians who were receiving the *regium donum,* and the incumbents, were to be secured. The aggregate of the payments would amount to about £8,000,000, leaving £7,500,000 at the disposal of Parliament. A general convention held in Dublin, 1870, adopted a constitution for the disestablished Church, according to which it was to be governed by a

General Synod, composed of a House of Bishops and a House of clerical and lay delegates, meeting annually in Dublin. The House of Bishops has the right to veto, but seven members must agree upon a veto to render it valid. The bishops are chosen by the diocesan convention, but if the convention fail to elect a candidate to a vacant see by a majority of two-thirds of each order, the election falls to the House of Bishops. The Primate, the Archbishop of Armagh, is elected by the House of Bishops from their own order. The property of the Church is vested in a permanent representative body, composed of three classes—the *ex-officio* archbishop and bishops, one clerical and two lay representatives for each diocese, and the co-opted members chosen by the *ex-officio* and representative members, and equal in number to the dioceses. One-third of the elected members retire by rotation. In 1901 the Church of Ireland had two archbishops (Armagh and Dublin), eleven bishops, a membership of over 600,000, and £8,128,440 in funds in custody of the financial trustees, the so-called representative body made up of the hierarchy, and 13 clerical and 36 lay representatives, elected by the General Synod. The general feeling among the members of this Church has been hostile to the introduction of High Church doctrines and practices, and the Prayer-Book has, since the disestablishment, been modified in this sense. See ENGLAND, CHURCH OF.

IRELAND, JOHN (1838—). An American Roman Catholic prelate. He was born at Burnchurch, County Kilkenny, Ireland, September 11, 1838, but was brought to the United States at the age of eleven, his parents settling at Saint Paul, Minn. In 1853 he was sent to France to be educated for the priesthood, to which he was ordained in 1861 on his return to Saint Paul. Here he remained, except for a period of service with the Fifth Minnesota Regiment in the Civil War, becoming rector of the cathedral. In 1875 he was made Coadjutor Bishop of Saint Paul, and on Bishop Grace's resignation, in 1884, succeeded him, the see being made metropolitan with the title of archbishop in 1888. The influence of his personality has made him a commanding figure in many important movements, especially those for total abstinence, for colonization in the Northwest (he was a director of the National Colonization Association), and for the establishment of the Catholic University at Washington. He is the author of *The Church and Modern Society* (1897).

IRELAND, WILLIAM HENRY (1777-1835). A Shakespearean forger, son of Samuel Ireland, engraver and author, born in London in 1777. After attending various private schools, he was sent to schools in France, where he remained four years. On returning to London, he was apprenticed to a conveyancer. In 1794 he visited Stratford-on-Avon with his father, who was preparing a book descriptive of the town. Here he met John Jordan, a Stratford poet, who had published much gossipy information in regard to Shakespeare, even forging the will of the dramatist's father. After the return of the Irelands to London, William began on his own account a series of remarkable forgeries, which deceived first his credulous father and then many scholars. He produced legal documents, verses, and letters purporting to be Shakespeare's, a number of sixteenth-century volumes with Shakespeare's name on the title-pages, the manuscripts of *Lear* and of a fragment of *Hamlet*, and finally two plays, *Vortigern* and *Henry II.*, which he tried to foist as Shakespeare's. On April 2, 1796, *Vortigern* was performed at Drury Lane amid peals of laughter. The same year young Ireland published a written confession, which he enlarged in 1805. Subsequently he wrote considerable verse in imitation of Chatterton, political squibs, and several Gothic romances. He died in London, April 17, 1835. His *Confessions* (1805) were reissued by R. G. White (New York, 1874). In December, 1795, the elder Ireland published facsimiles of the forged documents bearing the title *Miscellaneous Papers and Legal Instruments Under the Hand and Seal of William Shakespeare.* These forgeries James Payn made the subject of an interesting novel, *The Talk of the Town* (1885).

IRELAND ISLAND. One of the Bermudas (q.v.).

IRE'NA. The personification of Ireland, in Spenser's *Faerie Queene.*

IRENÆUS, I'rē-nē'ŭs (Lat., from Gk. **Εἰρηναῖος**, *Eirēnaios*), SAINT (c.130-c.202). Bishop of Lugdunum (Lyons), and one of the leading Church Fathers of the West. He was born in Asia Minor, perhaps about 130, and died after the year 200. He was a pupil of Polycarp, Bishop of Smyrna, who had been a disciple of the Apostle John. Thus Irenæus preserves a direct line of apostolic tradition. In 155 he accompanied Polycarp on a mission to Anicetus, Bishop of Rome, concerning the dispute between the Asiatic and the Western churches over the time of observing Easter. (See EASTER.) Some time after this he removed to Gaul, where he became a presbyter in the Church of Lugdunum. Pothinus, the aged Bishop of Lyons, suffered death in the persecution under Marcus Aurelius (177), and Irenæus was chosen to succeed him. Shortly before this time he visited Rome again, carrying letters with reference to the Montanists. (See MONTANUS.) The remainder of his life seems to have been passed in the successful administration of his see. When toward the end of the century the Easter controversy broke out afresh, and Victor, Bishop of Rome, threatened the Asiatic churches with excommunication unless they conformed to the Roman usage, Irenæus intervened with a fraternal letter to Victor, admonishing him to peace. Nothing is known about Irenæus's life after this time. A fifth-century tradition, which cannot be traced further back than Jerome, says that he met a martyr's death in the persecution under Septimius Severus (202). Gregory of Tours gives a full account of the alleged martyrdom in his *History of the Franks.*

Irenæus wrote in Greek. His work *Against Heresies* has survived only in a Latin translation. It was written in Gaul to combat the Gnostic teaching (see GNOSTICISM), and dates from 181-189. It is valuable for the history of doctrine. Fragments of some of his other works are preserved by the later writers. Harnack has recently shown that the so-called 'Pfaffian Fragments' were forged by Pfaff himself. The first edition of Irenæus's works was edited by Erasmus (Basel, 1526). Modern editions are by Migne, *Patrologia Græca*, vii., and Harvey (Cambridge, 1857). An

English translation of the *Adversus Hæreses* may be found in the *Ante-Nicene Fathers*, ed. by Coxe, vol. i. (Buffalo, 1885). In general, consult Cruttwell, *Literary History of Early Christianity* (London, 1893).

IRENE, ī-rē′nē (Lat., from Gk. 'Ειρήνη, *Eirēnē*) (c.752-c.804). Byzantine Empress from 780 to 802. She was a native of Athens, and in 769 married Leo, who became Emperor as Leo IV. in 775. Her husband died in 780, and Irene became Regent during the minority of her son, Constantine VI. A great worshiper of images—in fact, this had during the lifetime of her husband caused her to be banished from the Imperial palace—she quickly began to plot for their restoration, and with this purpose assembled a council of bishops at Constantinople, A.D. 786, which, however, was broken up by the troops of the capital. A second council held at Nicæa in the following year was more successful, and image-worship was reëstablished in the Eastern Church. (See IMAGE-WORSHIP and ICONOCLASM.) In 790 the Government was taken out of her hands by her son, but in 792 she was again in power, and in 797 she caused Constantine to be blinded and shut up in a dungeon, where he soon died. In 802 her treasurer Nicephorus rebelled, and banished her to the Isle of Lesbos, where she remained until her death, about 804. After the restoration of the Western Empire by Charles the Great (800) that monarch contemplated the revival of the ancient Roman Empire by his marriage to Irene, but these plans were frustrated by her fall. Irene had been successful in her wars against the Slavs, but she was defeated by Harun al-Rashid, and compelled to pay an annual tribute. Consult: Gasquet, "Charlemagne et l'impératrice Irène," in the *Annales de la faculté des lettres de Bordeaux* (1884).

IRENE, SAINT (c.1084-1124). A Byzantine Empress, daughter of Ladislas I., King of Hungary. In 1104 she married Emperor Johannes II., but lived for some time in a cloister before 1124, when she died. She was canonized by the Greek Church for her piety and charity. The name Saint Irene is often incorrectly applied to Irene, the wife of Leo IV., and enemy of the iconoclasts.

IRETON, ĭr′ton, HENRY (1611-51). An English general of the Commonwealth. He was the eldest son of German Ireton, of Attenborough, Nottinghamshire. He graduated B.A. at Trinity College, Oxford, in 1629, and studied law at the Middle Temple, London, but at the outbreak of the Civil War offered his services to the Parliament. At Naseby he was wounded and taken prisoner, but regained his liberty when Cromwell's Ironsides decided the fortunes of the day. In 1645 he became a member of Parliament, and took an active part in its disputes with the army. At first he favored a settlement between the King and Parliament, but upon being convinced of the impracticability of such an arrangement he became the King's implacable enemy, and was one of those who signed his death warrant. His connection with Cromwell, whose daughter Bridget he married in 1646, greatly advanced his interests. When Cromwell went to Ireland to subdue that country he was accompanied by his son-in-law, on whose vigor, judgment, and tact he placed much reliance. Cromwell's presence, however, was soon required in Scotland, and the complete subjugation of Ireland was intrusted to Ireton. His career was brief, severe, but successful. He compelled the surrender of Carlow, Waterford, Duncannon, and Limerick, and inaugurated a policy of civil government which was marked by fairness and religious sincerity. He died of an epidemic fever at Limerick. His remains were conveyed to England and interred in Westminster Abbey; but after the Restoration they were disinterred, hanged, and burned at Tyburn.

IRI, ē′rē. A river of Greece. See EUROTAS.

IRIARTE, ē′rē-är′tā, IGNAZIO (1620-85). A Spanish landscape painter, born at Azcoitia (Guipuzcoa). He studied under Herrera in Seville, and was one of the original members and the first secretary of the Academy of Seville (1660). He painted the backgrounds in some of Murillo's pictures, and Murillo, in turn, furnished the figures for his friend's landscapes. There are four well-composed, conventional landscapes by him in the Prado Museum at Madrid which show his talent as a colorist.

IRIARTE, or **YRIARTE, Y OROPESA**, ē′rē-är′tā ē ō′rō-pä′sā, TOMÁS DE (1750-91). A Spanish poet, born on the island of Teneriffe, September 18, 1750; educated at Madrid under the care of his uncle, Juan de Iriarte, the head of the Royal Library. He began very early to translate French plays and to compose plays of his own. For his maintenance, however, he depended throughout his life upon the income derived from certain minor posts to which he was appointed in the Ministry of Foreign Affairs and of War, and from other administrative appointments. The tranquillity of his career was somewhat disturbed by numerous literary quarrels with other writers of the time, notably with Juan Pablo Forner, and in 1786 he was summoned before the Inquisition to answer a charge of adherence to the doctrines which the French philosophers were then disseminating, a charge from which he seems, however, to have had little difficulty in clearing himself. He died at Madrid, September 17, 1791. Much of his published verse consists of translations, most of which are not so good as his original poems. Among these are the *Epistles*, one of which forms the dedication of his translation of Horace's *Ars Poetica* to his friend Cadalso, and a didactic work, *La musica*, a discussion of the elements of music, which attracted attention abroad and won him praise from Metastasio. But his permanent fame is based upon his versified fables, the *Fábulas literarias*, still among the most popular in Spain. In their content these show considerable skill on Iriarte's part in adapting the peculiarities and habits of animals to doctrinal purposes; in their form they also display his ingenuity, being written in a great variety of metres with a due regard for harmony and symmetry. Consult his *Obras* (Madrid, 1805); and the edition of his poems in the *Biblioteca de autores españoles*, vol. lxiii. (Madrid, 1891); Cotarelo y Mori, *Iriarte y su época* (Madrid, 1897). The fables were translated into many European languages. Belfour's *Literary Fables Imitated from the Spanish of Yriarte* appeared in London in 1806. and Rockliffe's rendering of Iriarte reached a third edition in 1866.

IRIARTEA, ĭr'ĭ-är'tē-ȧ (Neo-Lat., named in honor of Juan de Iriarte, a Spanish amateur botanist). A genus of South American palms which have lofty, smooth, faintly ringed stems, and pinnate leaves with somewhat triangular leaflets. The pashiuba or paxiuba palm (*Iriartea exorrhiza*, by some botanists called *Socratea exorrhiza*), common in low, wet grounds in the forests of the Amazon district, is remarkable for its aërial roots, which extend from the stem obliquely downward, and often divide into many rootlets just before they reach the soil. As the tree grows it produces new roots from higher points. Since the older and more central ones die, a man may walk erect with a palm of 70 feet high supported as on legs rising straight above his head. The outer wood, which is very hard, is used for harpoons. It splits easily into straight laths, is excellent for floors, ceilings, shelves, etc., and is exported for umbrella-sticks. The leaves are extensively used in Brazil as thatch.

IRIDACEÆ, ĭr'ĭ-dā'sē-ē (Neo-Lat. nom. pl., from Lat. *iris*, Gk. *ἶρις*, rainbow, sort of lily), or IRIS FAMILY. An order of monocotyledonous plants, consisting mostly of herbaceous perennials, with tubers or rhizomes. The leaves are usually in two rows and equitant (i.e. so placed that one seems to fit over the back of the other). The perianth is six-parted, colored, and in some kinds very beautiful. The stamens are three with anthers turned outward. The ovary is inferior with one style and three stigmas, which are often petal-like and add much to the beauty of the flower. The fruit is a three-celled capsule containing many seeds with small embryos in a hard endosperm. There are about 60 genera and 800 species known in temperate and tropical countries. South Africa and tropical America contain the greatest number. Some species, however, range to rather high latitudes. Familiar examples of the order are the garden irises, crocuses, gladioli, etc. Some species have acrid properties, while the corms of others are edible, and others have medicinal properties of considerable value. The classification by Pax, with the principal genera, is as follows: Crocoideæ, represented by Crocus and Romulea; Iridoideæ, with Iris, Morœa, Tigridia, and Sisyrinchium as the leading genera; and Ixoideæ, represented by Ixia, Tritonia, Gladiolus, and Freesia. See Colored Plates of IRIS FAMILY and FLEURS-DE-LIS.

IRIDESCENT GLASS (from Lat. *iris*, Gk. *ἶρις*, *iris*, rainbow). Glass containing a display of changing colors on the surface somewhat similar to the delicate hues of soap-bubbles. It is produced by rendering the surface of the glass imperceptibly uneven, either by artificial means or by the natural process of incrustation and decay. One form of treatment consists in applying to the surface of the glass to be treated a strong solution of hydrochloric acid under pressure in a closed vessel. Another method in use in many factories is to apply the fumes from chloride of tin or other chlorides volatilized in a reheating furnace. Glass which has for many years been submitted to the slowly disintegrating influences of natural causes, such as damp, successive heat and cold, light and darkness, will in many instances display an iridescent play of colors. The cause is due to a process of decomposition in the texture of the glass, resulting in the formation of minute scales. The action of water on glass has a tendency to extract the potash and soda which enter into its composition, together with a portion of the silica, the decomposition taking place with greater ease in proportion as the glass is richer in these alkalies, and more minutely divided, and the temperature of the water higher. The moisture in the atmosphere produces a similar alteration in the lapse of time. It separates the potash and soda, leaving the greater part of the silica with the lime on the surface of the glass. It is this decomposition which causes the prismatic colors. If subjected to heat, numerous fine scales will peel off and leave the surface dull, opaque, and wrinkled. Many attempts have been made to imitate by artificial means the singular display of changing hues, and varied success has attended the efforts. In Venice the workers succeeded in giving the surface of their glassware a peculiar kind of metallic iridescence, and a similar result was reached by certain Hungarian glass-workers. The beautiful *Favrile Glass* made by Tiffany of New York has a most striking iridescent play of color. See GLASS.

IRID'IUM (Neo-Lat., from Gk. *ἶρις*, *iris*, rainbow; so called on account of its iridescence). A metallic element discovered in 1803 by Smithson Tennant. It is found in platinum ores; as iridosmine, a native alloy of iridium and osmium in varying proportions; and in the form of native alloys with the other platinum metals. The principal sources of these ores are various districts in the Ural Mountains, and on the Pacific Coast of the United States. The preparation of metallic iridium involves its separation from the accompanying metals by a long and complicated process.

Iridium (symbol Ir; atomic weight, 193.5) is a white steel-like metal, brittle when cold, and somewhat malleable at a white heat. In its ordinary, compact form, iridium is insoluble not only in the several mineral acids, but also in aqua regia; the latter reagent, however, dissolves iridium powder, which may also be converted into the oxide Ir_2O_3 by heating in the air. Iridium has a specific gravity of 22.4, and it melts at 2300° C. It combines with oxygen to form an iridium sesquioxide and an iridium dioxide, which in turn give rise to iridious and iridic salts. The metal itself alloys with copper, gold, and lead, as well as with other platinum metals, and the alloy consisting of nine parts of platinum with one part of iridium is extremely hard, as elastic as steel, perfectly unalterable in the air, and capable of taking a high polish. It is of this alloy that the standard meter kept in Paris was made. Iridium is also used for the manufacture of standard weights, knife edges of balances, and for other articles which it is desired to preserve from the influence of the atmosphere. It has been used in the United States to tip the edges of gold and other pens so as to produce a very hard surface. William L. Dudley of Cincinnati invented a process, in 1880, for the electrolytic deposition of this material, and his process is now successfully used for coating surgical instruments and other articles requiring an exceedingly hard surface.

IR'IDOS'MINE (from *irid*-ium + *osmium*). A native alloy of iridium and osmium that crystallizes in the hexagonal system. It is tin-white to light steel-gray in color, and has a metallic lustre. The proportions of iridium and osmium in it vary, and other platinum metals, such as platinum, rhodium, and ruthenium, are frequently present. The mineral occurs with platinum minerals in the Ural Mountains, in the auriferous drifts and sands in New South Wales, and in northern California.

IRIGA, ē-rē′gȧ. A town of Luzon, Philippines, in the Province of South Camarines (Map: Philippine Islands, H 6). It lies about 22 miles southeast of Nueva Cáceres, and has a population (1898) of about 17,100.

I′RIS (Lat., from Gk. Ἶρις). In Hesiod, the daughter of Thaumas and Electra, and sister of the Harpies (q.v.). In the Homeric poems she is the virgin messenger of the gods; but Alcæus and later writers state that she was the wife of Zephyrus and the mother of Eros. She is frequently represented on vases and in bas-reliefs as a youthful winged virgin, with a herald's staff. The name in Greek means 'rainbow,' and though Vergil is the first writer to represent the bow as the path of the goddess, there can be no doubt of their original connection. It may be noted that to the Greeks the rainbow was a divine portent, presaging war or heavy rain. Consult: Mayer, "Iris," in Roscher, *Lexikon der griechischen und römischen mythologie* (Leipzig, 1890-94).—Iris is also the name of one of the planetoids (q.v.), discovered in 1847.

IRIS (Lat., from Gk. ἶρις, rainbow, sort of lily), or FLOWER-DE-LUCE. A genus of plants of the natural order Iridaceæ, having the three outer segments of the perianth reflexed, the three inner arched inward, and three petal-like stigmas covering the stamens. The species are chiefly natives of temperate climates, especially of North America and Europe. The yellow iris, or corn-flag (*Iris Pseudacorus*), is a well-known native of moist grounds in many parts of Europe, often spreading over a considerable extent of land, and conspicuous even at a distance by its tall leaves and large, deep-yellow flowers. It is also established in a few places in the Eastern United States. The stinking iris (*Iris fœtidissima*) a species with livid purple flowers and ill-smelling leaves, is very abundant in the south of England, but does not extend far north. The flowers of most of the species are beautiful. Some of them have received much attention from florists, particularly *Iris xiphium,* sometimes called Spanish iris; *Iris xiphioides*, or English iris; and *Iris germanica,* or common iris, all European corm-rooted species, and the Japanese irises, which probably are well referable to *Iris lævigata*. Many fine varieties have been produced. The Persian iris (*Iris persica*) is delightfully fragrant; the snake's-head iris (*Iris tuberosa*) and the Chalcedonian iris (*Iris Susiana*) are also much esteemed. The roots of all these species are annually exported in considerable quantities from Holland. Many other species are of frequent occurrence in flower-gardens, such as *Iris reticulata* and *Iris atrofusca.* The fresh rootstocks of *Iris Pseudacorus* are very acid. Those of *Iris florentina, Iris pallida*, and *Iris germanica* are orris-root (q.v.). Some species have edible rootstocks. *Iris versicolor*, the large blue flag, is common in wet places through the United States as far west as Minnesota and Arkansas. *Iris cristata* is a dwarf species with fragrant flowers found in several localities, and *Iris verna* and *Iris lacustris* are other dwarf American species, all of which are cultivated as border plants to a considerable extent. See IRIDACEÆ and accompanying Colored Plates.

IRIS (Gk. ἶρις, *iris*). A term used in anatomy to denote the thin circular curtain, pierced by the pupil, which hangs in the anterior chamber of the eye in front of the crystalline lens. It is attached by its peripheral margin to the sclera, and its posterior surface is pigmented. See EYE; VISION; IRITIS.

IRIS FAMILY. A family of plants. See IRIDACEÆ.

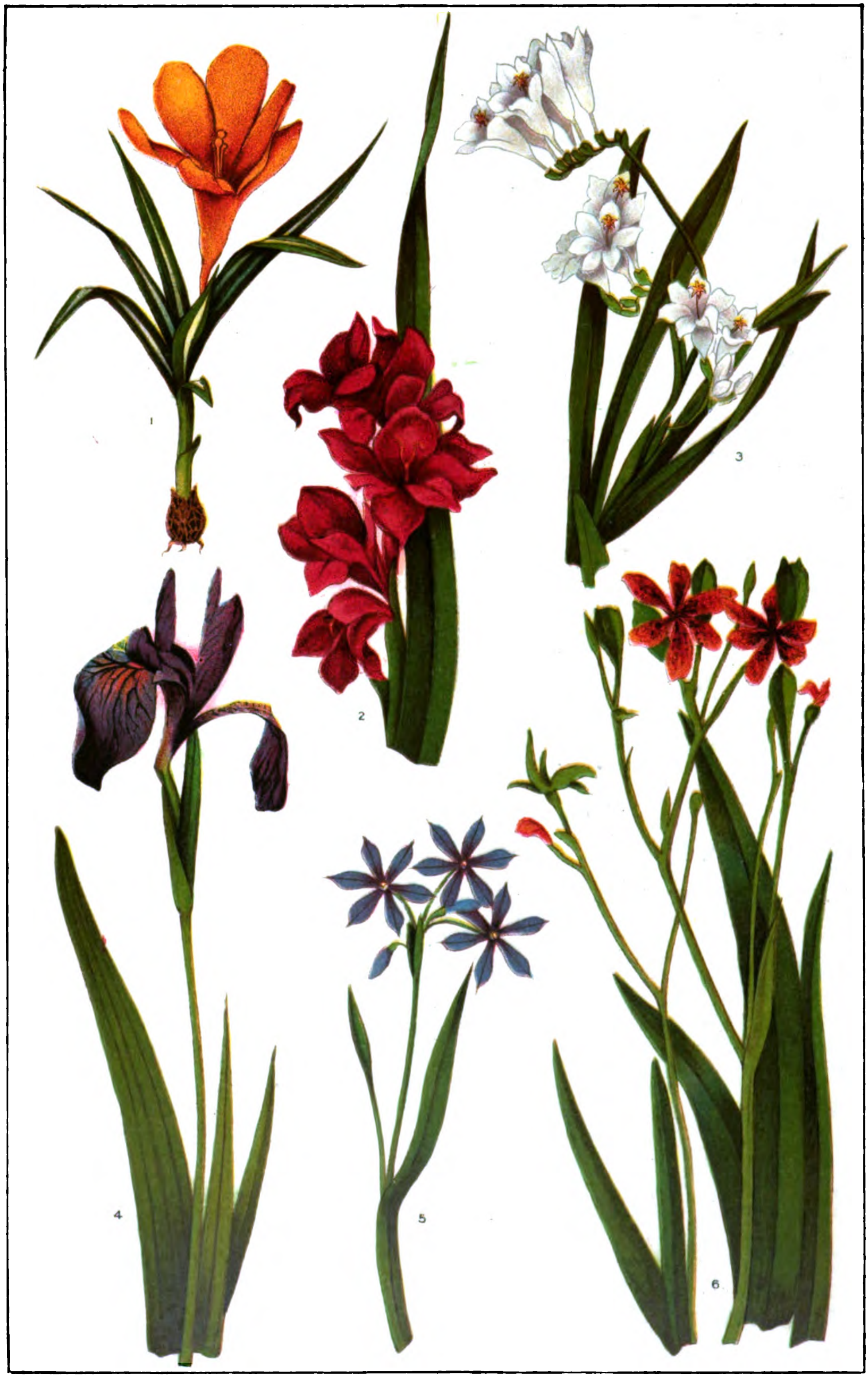
IRISH ACADEMY, ROYAL. A learned association in Dublin, Ireland, incorporated in 1786, with the object of promoting the study of science, polite literature, and antiquities. It is governed by a council consisting of twenty-one members divided into three committees, viz. the Committee of Science, the Committee of Polite Literature, and the Committee of Antiquities. The meetings of the council are distinct from those of the Academy at large, and are held every month from November to June. The library contains a collection of Irish manuscripts, in themselves invaluable, besides papers of public interest, including those of the Ordnance Survey of Ireland. Its collection of Irish antiquities now on exhibition in the National Museum, Dublin, under the Science and Art Departments of the Academy, is both interesting and important.

IRISH CATHOLIC BENEVOLENT UNION. A fraternal and benevolent organization, founded at Dayton, Ohio, in 1869, for social and beneficial purposes. Membership in the union is confined to those who are of Irish extraction, and who are members of the Roman Catholic Church. Since the organization of the union, the sum of $2,124,209 has been disbursed to the beneficiaries of deceased members, and during the fiscal year of 1901-02 the benefits disbursed amounted to $45,371.71. The number of subordinate societies in the union is 149, with a total membership of 13,623.

IRISH DEER. See DEER; ELK.

IRISH LAND LAWS. The land tenure of Ireland is the product of two distinct systems, the Irish tribal and the English feudal. In the former, as described in the Brehon laws, the land was ultimately the property of one of the four or five tribes into which the Irish population was divided. A portion of this land was set aside for the chief or king of the tribe, but by far the greater part of it belonged to the different clans of which the tribes were composed. The clan lands were subdivided among the septs, which were the lowest social units. Land was set aside both for the chiefs of the clans and the chiefs of the septs. The greater part of the sept land, however, was held by the free tribesmen, who owed both rents and military service to their immediate chiefs. These tribesmen held their lands by different kinds of free tenure. The Ceil had herds of cattle (the chief wealth of the country) of his own, while to the Saer and the Daer tenants cattle were lent by the chief. Besides these there were servile tenants (the Fuidhir), who were not original

IRIS FAMILY



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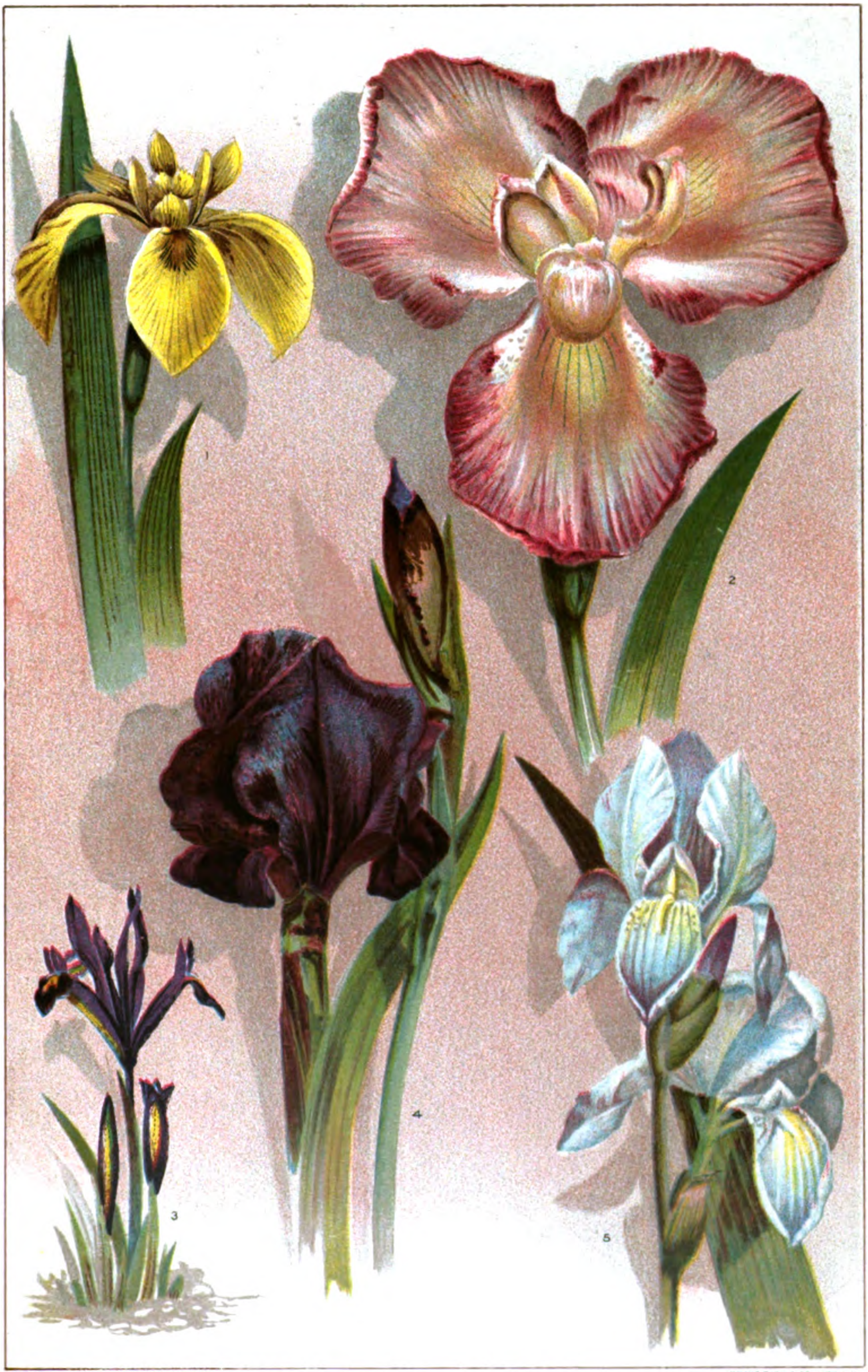
1 YELLOW CROCUS – CROCUS SUSIANUS
2 GARDEN GLADIOLUS – GLADIOLUS COMMUNIS
3 FREESIA – FREESIA REFRACTA
4 BLUE FLAG – IRIS VERSICOLOR
5 BLUE-EYED GRASS – SISYRINCHIUM GRAMINOIDES
6 BLACKBERRY LILY – BELAMCANDA PUNCTATA

FLEURS-DE-LIS



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1 ENGLISH YELLOW IRIS – (IRIS PSEUDACORUS)
2 JAPANESE IRIS – (IRIS LÆVIGATA)
3 NETTED IRIS – (IRIS RETICULATA)
4 CUSHION IRIS – (IRIS ATROPURPUREA ATROFUSCA)
5 FLORENTINE IRIS (IRIS FLORENTINA)

members of the tribal community. These were personally dependent on the chief, who had a right to quarter his retainers upon them or rackrent them at pleasure. It is impossible to determine the numerical proportion of the population represented by these servile tenants, but it is probable that at the time when the English system was superimposed upon Ireland the free element was predominant.

Under the Irish system, land was conceived to be held on a communal basis. On the death of the chief his land was distributed among his descendants by the tribesmen, and on the death of a tribesman the chief redistributed the land of the sept. In contrast to this, under the English feudal system, the King was conceived to be the ultimate owner of the land, and the lords and other tenants derived their ownership from him. The English law in Ireland, however, prevailed only within the Pale, while the Irish law prevailed in by far the greater part of the country. The evils of the Irish land system are to be ascribed to the dispossession of the native population and to the forced imposition of the English land law upon Ireland. The dispossession began under Queen Mary, when the Irish were driven out of King's and Queen's counties and the English settlers established there. Under pretext of the treason of two Ulster chiefs, James I. in 1607 established the famous Ulster plantation. Later in his reign other confiscations, though not such extensive ones, were made. All Ireland was divided into shires and declared subject to English laws. This policy was continued during the succeeding reigns, but no second great confiscation was attempted until the time of the Commonwealth. After his Irish victory Cromwell divided the best lands of Leinster and Munster and a part of the lands in Ulster among 40,000 of the English soldiery. A small portion of this land was restored under Charles II. and James II., but more was confiscated by Parliament under William III.

The effect of these measures was to dispossess almost the entire Irish nobility and gentry. The penal laws enacted by the Irish Parliament after the defeat of James II. carried this principle still further by making it impossible for a Catholic to acquire land. The confiscation acted with equal severity upon the lower classes. The English law confounded all Irish tenantry with the Fuidhir class, reducing them thus to a servile status. The lands were increasingly held by absentee landlords, who endeavored to obtain the highest possible rents. The large number of middlemen who held land under the lords and acted as their agents made the condition of the peasantry still worse. The need of reformation was seen by all classes, but was not fully realized by English statesmen until the report of Lord Devon's commission, which was appointed in 1843 and sat for two years. This report, backed by the famine of 1846, showed conclusively that the cause of the poverty and suffering in Ireland was not due, as was generally supposed in England, to the shiftlessness of the Irish people, nor yet to their religion, but to the disastrous relations that existed between landlord and tenant. It recommended that the tenant receive from the landlord compensation for the improvement of his holding. Accordingly in 1847 Lord Russell proposed a measure providing for such compensation in cases of eviction, but it was rejected by Parliament. His second measure, the Encumbered Estates Act, however, was accepted. This act compelled the sale of estates upon which the rents were mortgaged, the idea being that a new set of solvent landlords would not need to rackrent the tenants. This act, however, was a failure. Estates to the value of £25,000,000 were sold for £10,000,000, and the incoming landlords, regarding their possessions as purely financial investments, had less consideration for the customs which formerly safeguarded the tenantry than their predecessors.

In 1850 the Tenant Right League, composed alike of Presbyterians and Catholics, was founded at Dublin. It contended for fair rents by actual valuation, excluding the improvements made by the tenantry, for continued possession of the holding by the tenant as long as valuation rents were paid, and for relief from arrears of rent due from the time of the famine. The League entered actively into political affairs, and in 1852 sent fifty members to Parliament pledged to adhere to no party that did not support the principles of the League. Three of its leaders were won over by the Liberal Cabinet, and its strength was broken by the opposition of the Roman Catholic hierarchy and the Holy See. In consequence of renewed agrarian disturbances, the Palmerston Ministry brought forward the Land Acts of 1860.

The first really efficient land legislation enacted for Ireland was a consequence of the attempted Fenian rebellion, and was the work of the Gladstone Ministry in 1870. It established the Ulster custom throughout Ireland. This custom provided that tenants could not be evicted while their rents were paid, and that whenever a tenant gave up possession, either voluntarily or otherwise, he might sell his own improvements. Evictions for non-payment of rent could only be made in case of three years' arrears, and could not be made at all in cases where the rent was under £15 if the court deemed the rental exorbitant. When a holding was relinquished a tenant could legally claim compensation for his own improvements from the landlord. The Bright clause provided for the purchase of the holding by the tenant by enacting that the Board of Works should advance two-thirds of the purchase-money.

The act of 1870 failed, however, to remedy the existing evils.

The Land Act of the second Gladstone Ministry, passed in 1881, was a result of the disturbances fostered by the Land League (q.v.). It was drawn up by Forster, the Irish Secretary. This act recognized that the tenant had a possessory right in the holding, by the provision that he might sell it for whatever it would bring, subject only to the landlord's right of preëmption. Except for the non-payment of rent, the tenant could not be evicted. In case of the increase of rent he could apply to the Land Commission, established by the act, and procure a rate which would hold for fifteen years. This commission also provided for the easy payment of arrears. The clause providing for the purchase of the holdings by the tenants was strengthened in 1885 by the Ashbourne Act, which advanced £5,000,000 for this purpose. In 1887 an additional £5,000,000 was advanced. The Balfour Land Purchase Bill passed by the Conservatives in 1891 continued the same policy. It provided for purchase based on voluntary agreement between landlord and tenant, the Government advancing the entire purchase-money, such sum to be repaid by the tenants in forty-one annual 4 per cent. payments. The fund created for this purpose was £30,000,000, a sum deemed sufficient to establish peasant proprietorship in Ireland. John Morley's Land Law of 1896 improved the application of the law. Nevertheless, agitation did not end, and in January, 1898, the United Irish League was founded, which aims, among other things, to agitate for the abolition of the dual ownership of land, and the redistribution of the grazing-ranches of Connaught among the small holders. In 1902 a conference between representatives of the landlords and tenants to settle the land question was urged, and a preliminary meeting was held at Dublin, on December 20, 1902. As a result of the agreements reached at that meeting, the Balfour Government introduced, on March 25, 1903, a comprehensive measure for the final settlement of the Irish land question. The bill provided for a free grant of £12,000,000 with which to purchase the interests of landlords upon the basis of voluntary agreement. It furthermore authorized Government loans to be made to tenants at the rate of 3¼ per cent. per annum, in order to enable them to acquire title to the lands which they were occupying, the amount which each tenant might borrow being limited to £500 in the congested districts and £1000 elsewhere. The bill also provided that untenanted farms and grazing lands should be sold to neighboring tenants, and that three commissioners, known as Estates Commissioners, should supervise the sales. See Land League.

The Report of the Devon Commission was published at Dublin in 1887. For early Irish land laws, see Maine, *Lectures on the Early History of Institutions* (London, 1875), lect. ii.; Guinell, *The Brehon Laws* (London, 1894). Of the many modern works on the subject, the following are among the best: Richey, *The Irish Land Law* (London, 1881); Dun, *Landlords and Tenants in Ireland* (London, 1881); Fisher, *History of Landholding in Ireland* (London, 1877); Sigerson, *History of Land Tenure in Ireland* (London, 1871); Montgomery, same title (Cambridge, 1889); Godkin, *The Land War in Ireland* (London, 1870).

IRISH LANGUAGE. See Celtic Languages.

IRISH LANGUAGE, Society for the Preservation of the. A society with headquarters in Dublin founded in 1877 for the restoration of the ancient Gaelic tongue as a spoken language. The movement of which this organization is the result had its origin in Boston, Mass., in the Philo-Celtic Society, which was organized in 1873. From there it spread to other parts of the United States and finally attracted the attention of scholars in Ireland, where eventually the society became firmly established. See Ireland.

IRISH LITERARY SOCIETY. A society for the study of the Irish language, literature, history, music, and art, founded in London in 1892 by a small coterie of young Irish men and women, with the coöperation of leading Irish literary men in England and Ireland. The society has a large library of Irish books, and during each season provides lectures on Irish subjects, and social entertainments for its members and their friends. The membership is about six hundred, and includes the names of many prominent littérateurs, among whom may be mentioned Rev. Stopford Brooke, W. B. Yeats, Justin McCarthy, and Barry O'Brien. The society, though located in London, is well represented in Ireland.

IRISH (Gaelic) **LITERATURE.** Irish literature shows an unbroken, if varying, continuity from the seventh or eighth century until the nineteenth. In its earlier periods it is of especial interest, and in some kinds of production ranks with the richest literatures of mediæval Europe.

Three periods are regularly recognized by scholars in the history of the Irish language: Old Irish, from the time of the earliest monuments through the tenth century; Middle Irish, from the eleventh century to the seventeenth; and Modern Irish, from the seventeenth century to the present time. It is convenient to follow the same divisions in treating the history of Irish literature, though there is no such well-defined distinction between the literary productions of successive periods as between the corresponding stages of the language.

Old Irish. There is an abundance of material for the study of the Old Irish language. The most archaic stage is represented by the Ogam inscriptions, some of which date from the fifth and sixth centuries. They contain little besides proper names, but these are of great interest for the light they throw upon the beginnings of Celtic phonology and inflection. (See Ogam.) From the period between the seventh and the tenth century a score or more of manuscripts have been preserved containing thousands of Irish glosses, and on the basis of these a very complete grammar of the Old Irish language has been constructed. Unfortunately, only a few continuous Irish texts exist in any of these early manuscripts. An ancient Latin-Irish sermon, a short sketch of Saint Patrick's life, a few poems and incantations—this is about all that is preserved of the oldest Irish literature in contemporary copies. We have to wait for the Middle Irish manuscripts before we find much direct evidence of its character. However, many of the texts in these later manuscripts are composed in a language only half contemporary with the writers; they abound in archaic forms, which make it safe to set them down as being substantially Old Irish, in spite of the circumstances of their preservation. The reason for the scarcity of early literary monuments is to be found in the political conditions of Ireland from the eighth to the tenth century. This was the Viking age, and Ireland with the rest of Western Europe suffered from the ravages of the Norsemen. Monasteries were repeatedly sacked and burned by the Scandinavian invaders, and few libraries survived the struggle. Nearly all the manuscripts of the Old Irish period have been preserved on the Continent.

Middle Irish. In 1014 the Scandinavians were defeated in the battle of Clontarf, and from that time forth their power in Ireland declined. From the period between about 1100 and about 1500 there has come down to us a great body of manuscripts containing a vast variety of writings, in both prose and verse. Among the most important of these Middle Irish manuscripts are the *Liber Hymnorum*, and the *Book of the Dun*, written about 1100; the *Book of Leinster*, of the twelfth century; the *Yellow Book of Lecan*, the *Leabhar Breac* (Speckled Book), and the *Book of Ballymote*, all of the fourteenth century; and the *Book of Lecan*, from about the beginning of the fifteenth.

The religious element in Middle Irish literature, consisting of hymns and sermons, theological treatises, and lives of saints, bears a general resemblance to contemporary writings in other vernacular languages of Europe. The poetry is largely conventional and technical, but it often reveals a fine fancy and a strong love of nature.

In metrical form it is highly intricate and shows great artistic skill. Chief interest, however, attaches to the heroic sagas, which constitute the best contribution of the Irish to the world's literature. These hero-tales fall into three main groups: (1) The so-called *mythological* cycle, which relates various traditions about the early settlement and conquest of Ireland; (2) the *Ultonian* cycle, which tells of the wars between Ulster and Connaught in the time of King Conchobar; and (3) the *Ossianic* cycle. The tales of the first group are chiefly interesting for the light they seem to throw on the ancient Celtic pantheon. The characters are generally held to be derived by a process of euhemerism from the gods of the old mythology. The cycle of King Conchobar of Ulster represents ancient Irish literature at its best. While not uninfluenced by foreign thought, these old sagas are in the main a representative national product, and they furnish the best existing record of what the ancient Celtic people must have been. They were composed in a mixed prose and verse, which long remained the typical Irish epic form. Many of the sagas of this group seem to have taken practically their final shape before the end of the Old Irish period. The third cycle—that of Finn and Ossian—is found in later manuscripts than the second, and the tales are composed in a more modern language. The events with which they deal are supposed to have taken place two or three centuries after those of the earlier group. The Ossianic cycle shows more traces of foreign influence, and in the opinion of some scholars owes its origin and character largely to the contact of the Irish with the Scandinavian people. But it is more likely that the stories of Finn were in the main a native product, and they have continued down to this day to be a favorite body of tradition with Irish and Scottish Gaels alike.

In addition to these three saga cycles, there exist in Middle Irish manuscripts many separate tales, or groups of tales, of interest and importance. The *Immrama*, or stories of marvelous voyages, deserve special mention both because they go back to very ancient Celtic tradition and because they appear to have had considerable influence on mediæval literature in other tongues. The *Voyage of Bran*, the oldest and in some respects the most interesting of this series, can safely be dated in the Old Irish period. An entirely different literary vein is represented by the *Vision of MacConglinne*, a satire of which the fun has seldom been surpassed. Far removed from either of these types is the story of the *Sons of Eochaid Muigmedoin*, who have an adventure similar to that related in Chaucer's tale of the Wife of Bath. Middle Irish translations (or adaptations) of foreign material are preserved in considerable number, and represent a wide variety of originals from the tale of Troy to the travels of Sir John Maundeville.

Modern Irish. Throughout the older periods of Irish literature nearly all the greatest works are anonymous. In the Modern Irish period this is less the case. The later literature is on the whole less significant than the earlier, but the writers, as such, claim more attention. At the beginning of the period stand several prose writers of first importance: the Four Masters, who compiled the greatest collection of Irish annals; Duald MacFirbis, the genealogist; and Geoffrey Keating (also a poet), whose religious writings and *History of Ireland* are the standards of classic Irish prose. Treatises in prose, chiefly religious, continued to be written throughout the seventeenth century; but, as education declined among the Irish-speaking population, literature of this sort found itself without a public, and died out. Poetry, on the other hand, continued to be cultivated; and the work of the modern poets, though it seldom rises high in thought or imagination, possesses great melody and charm. Much of it is distinctly popular in character, and has long been common property of the Gaels in both Ireland and Scotland. The seventeenth century witnessed a great change in the form of Irish poetry. The metrical system of the old bardic schools, in which syllable counting and consonantal rhyme were the controlling principles, gave way to a new verse-form, in which the accent was the unit of measure and the rhyme was primarily vocalic. The use of vowel-rhymes was extended till it applied to all the accented syllables in the line, and a strangely melodious verse-form resulted, in which whole poems are constructed with the same accented vowels recurring throughout in orderly sequence. The two systems existed side by side throughout the seventeenth century; but in the eighteenth, after the disappearance of the old bardic schools, the use of the newer metres became practically universal. The chief representatives of the classic style in its final stage were Teig mac Daire and Lughaidh O'Clery (the leaders in the great "Contention of the Bards"), Teig Dall O'Higin, and Eochaidh O'Hussey. The later school of poets was very numerous, especially in the eighteenth century. Among the most representative of the number were David O'Bruadar, John O'Neaghtan, Torlough O'Carolan, Brian Mac Giolla Meidhre (whose "Midnight Court" is one of the most remarkable pieces in Modern Irish), Timothy O'Sullivan ('Tadhg Gaolach'), Egan O'Rahilly, and Owen Roe O'Sullivan.

In the nineteenth century even poetry ceased to be much written in Ireland, and the native language fell into disuse for literary purposes. Only in very recent years has a movement been set on foot to restore the language to general use and to revive Irish literature. An organized effort is being made to bring this about, and Irish books and periodicals are being published in large numbers every year.

Two societies have been especially active in the revival: the "Society for the Preservation of the Irish Language," which has long labored to get more recognition for Irish in the schools; and the Gaelic League, a very large organization, which has lately waged a lively popular campaign all over the country. Dr. Douglas Hyde (q.v.), the president of the League, has been one of the leaders in the movement. Among others who have borne an important share in the work should be mentioned the late Father Eugene O'Growney, whose *Simple Lessons in Irish* have become the most widely used of Gaelic text-books, and Fathers P. J. Dinneen and Peter O'Leary, who have contributed largely as authors and editors to the publications of the League.

Bibliography. General. O'Reilly, *Irish Writers* (Dublin, 1830); O'Curry, *Lectures on the Manuscript Materials of Ancient Irish History* (ib., 1861); and id., *On the Manners and Customs of the Ancient Irish People* (ib., 1873). Much of the contents of these older works is now superseded. Hyde, *A Literary History of Ireland* (New York, 1899), represents better the present state of information.

Old Irish. Stokes and Strachan, *Thesaurus Palœhibernicus*, part i. (Cambridge, 1901). The completed work will contain all the Old Irish monuments.

Middle Irish. Stokes and Windisch, *Irische Texte* (Leipzig, 1881-1900); O'Grady, *Silva Gadelica* (London, 1892). Numerous texts have appeared in the *Revue Celtique*, the *Zeitschrift für Celtische Philologie*, the *Anecdota Oxoniensia*, and the publications of the Royal Irish Academy, the Irish Archæological Society, the Celtic Society, and the Irish Texts Society.

Modern Irish. Atkinson's edition of Keating, *Three Shafts of Death* (Dublin, 1890), is the best introduction to the modern language. Keating's *History of Ireland* is being edited by D. Comyn for the Irish Texts Society (vol. i., 1902). Brooke's *Reliques of Irish Poetry* (Dublin, 1789), Hardiman's *Irish Minstrelsy* (London, 1831), O'Daly's *Poets and Poetry of Munster* (Dublin, 1850), and *The Irish Language Miscellany* (Dublin, 1876), represent the poetry of the last two or three centuries. Several poets of this period have been published very lately in the "Irish Texts Series" of the Gaelic League. Douglas Hyde's *Songs of Connacht* form also an important collection. The literature of the present language movement will be found principally among the publications of the Gaelic League. In folk-lore the collections of T. Crofton Croker, Jeremiah Curtin, Patrick Kennedy, William Larminie, D. O'Foharta, and Douglas Hyde all deserve mention.

IRISH LORD. A yellowish, sculpin-like fish (*Hemilepidotus Jordani*) of the waters about the Aleutian Islands, which is of great importance as food to the Aleut islanders. This is also known as 'yellow sculpin,' and a more southerly species of the same genus is called 'red sculpin.' Both are mottled or barred blackish, and are from one to two feet in length.

IRISH MOSS. An edible seaweed. See Carrageen.

IRISH MUSIC. See Celtic Music.

IRISH POMPANO. A West Indian food-fish (*Gerres olistho-stomus*), one of the mojarras (q.v.), and also called 'mutton-fish.'

IRISH SEA. The almost circular middle expansion of the channel separating Ireland from Great Britain (Map: Europe, C 3). It connects with the Atlantic to the north by North Channel between Southwestern Scotland and Northeastern Ireland, and to the south by Saint George's Channel between Wales and Southern Ireland. Its greatest width is 140 miles, and its length from north to south is nearly the same. It contains the Isle of Man in the north central part, and Anglesey in the southeast.

IRISH SMOLLETT, The. A name given to Charles James Lever.

IRISH TERRIER. See Terrier.

IRISH TEXTS SOCIETY. A society formed in London to promote and foster the study of ancient Irish texts and to undertake their publication. The third volume of the society's publications was issued in 1900 and contained a complete collection of the poems of Egan O'Rahilly. The volume for 1901 consisted of *Keating's History of Ireland*, edited by David Comyn. An *Irish-English Dictionary* to be issued by the society is now (1903) in press.

IRIS-ROOT. The fragrant root of various species of iris. See Orris-Root.

IRISSON, ē'rē'sôN', Maurice Hérisson, Count of. See Hérisson, Maurice.

IRI'TIS (Neo-Lat., from *iris*, iris). Inflammation of the iris. The objective symptoms of iritis (those which can be observed by the physician) are: (1) Redness of the eye, arising from vascularity of the sclerotic around the cornea and general redness of the sclerotic from accompanying conjunctivitis. (2) Change in the color of the iris. When there is an exudation into the iris, a gray or blue eye is rendered greenish, while in a dark eye a muddy reddish tint is produced. The brilliancy of the color of the iris also disappears. When the inflammation is very violent, or has been unchecked by remedies, suppuration may take place, the pus settling at the lower part of the anterior chamber. (3) Irregularity, sluggishness, and sometimes immobility of the pupil, produced by the adhesion of the back of the iris to the crystalline lens. The subjective symptoms (those of which the patient is conscious) are intolerance of light, dimness of vision, pain in and around the eye, and lachrymation. The disease is often confused with acute catarrhal conjunctivitis. Many acute cases recover under treatment in a few weeks; others run a more mild but chronic course. Complicating inflammation of the deep portions of the eye increases the danger. Iritis may be followed by adhesions between the iris and lens, occlusion of the pupil, glaucoma, and sometimes blindness. Iritis may be primary, or secondary to inflammation of other portions of the eye. The primary cases are often caused by syphilis, rheumatism, injury, or, less frequently, by tuberculosis, gonorrhœa, acute infectious diseases, or diabetes. In the so-called idiopathic iritis no cause is found. The treatment consists in absolute rest of the eye, with protection from light, the application of moist, warm compresses, local blood-letting, and dilatation of the pupil by the instillation into the eye of a weak solution of sulphate of atropine, with the view of preventing adhesion of the iris, or of breaking, or, at all events, of stretching and elongating any adhesive bands that may be formed; and thus of preventing any impairment of the movements of the iris, and any irregularity of the pupil after the inflammation shall have abated. When this is done the result must be carefully watched by the physician. Constitutional treatment must be directed to the cause of the inflammation, especially in cases of syphilitic origin. See Eye, Diseases of the.

IRKUTSK, ėr-ko͞otsk′. A governor-generalship and a government of Eastern Siberia. The former comprises the governments of Irkutsk and Yeniseisk (q.v.), and the Territory of Yakutsk (q.v.), with a total area of nearly 2,800,000 square miles, and a population in 1897 of 1,328,150 (Map: Asia, K 3). The Government of Irkutsk is bounded by the Territory of Yakutsk on the north, the territories of Yakutsk and Trans-Baikalia on the east, the Chinese Empire on the south, and the Siberian Government of Yeniseisk on the west. Area, nearly 280,000 square miles. Its surface is generally mountainous. The Sayan Mountains run along the southern boundary; the Baikal Mountains along the western shore of Lake Baikal. The chief rivers are the Lena, which rises in the Baikal Mountains, and the Angara, with its numerous mountain tributaries. Irkutsk takes in a large portion of Lake Baikal. The mountains of Irkutsk are rich in minerals, containing deposits of iron, coal, graphite, and salt. The climate is raw and severe, the annual average temperature at the capital being about 32°. Only an insignificant portion of the cultivable land has been cleared, by far the larger part of the country being covered with forests, filled with fur-bearing animals. The land wherever cultivated is fertile and yields ample crops of rye, wheat, oats, barley, buckwheat, and potatoes. The raising of domestic animals is confined mostly to the natives. The manufacturing as well as the mining industries are as yet only slightly developed, the former being concentrated mostly in the town of Irkutsk. The population (506,500 in 1897) consists mostly of Russians, Buriats, Tunguses, and Jews. Capital, Irkutsk (q.v.).

IRKUTSK. The capital of the Governor-Generalship and of the Government of Irkutsk, and the finest city of Siberia, situated at the confluence of the Irkut with the Angara, 40 miles north of the southern extremity of Lake Baikal and 3385 miles by rail from Moscow (Map: Asia, K 3). It was almost entirely rebuilt after the destructive fire of 1879, and is now a handsome, well laid out city, with well-paved, wide streets, and all the essential features of a modern city. The climate is healthful, owing to the high altitude of the city; the winters, however, are severe. There are in Irkutsk a theatre, a library, a museum, a meteorological station, and a branch of the Imperial Geographical Society. The manufactures are unimportant, and go mostly to satisfy domestic demands. The commerce is of great importance, Irkutsk being one of the chief centres of the Russian tea trade, as well as one of the principal stations on the Trans-Siberian Railway. Population, in 1897, 51,400, including 4500 exiles. Irkutsk was founded by Cossacks in 1653, created a town in 1686, and soon became the centre of the Russo-Chinese tea trade.

IRMINUS (AS., exalted). The divine ancestor of the Germanic Hermiones, probably identical with Tiw or Tyr. The Saxons erected in his honor great tree-trunks, the so-called Irminsûli, e.g. at Scheidungen, after the defeat of the Thuringians, and at Eresburg, Westphalia. The latter, which was looked upon as the national shrine, was destroyed by Charles the Great in 772.

IRNERIUS, ĕr-nē′rĭ-ŭs, or **GUARNE′RIUS** (c.1050-c.1130). An eminent Italian jurist, founder of the so-called School of Glossators. He was born at Bologna. When quite young he taught in his native city dialectics and rhetoric, but soon devoted himself entirely to the study of the Justinian Code, probably in Rome, where he also seems to have lectured on law. In or about 1084 he returned to Bologna, and there established a new law school. His most important work is the *Summa Codicis* (first ed. by Fitting, 1894), formerly attributed to Placentin. Consult Fitting, *Die Anfänge der Rechtsschule in Bologna* (1888).

IRON (AS. *īren*, *īsern*, Goth. *eisarn*, OHG. *īsarn*, *īsan*, Ger. *Eisen*, from OIr. *iarn*, Welsh *haiarn*, Corn. *hoern*, Bret. *hoiarn*, iron; possibly connected ultimately with Lat. *æs*, Goth. *aiz*, OHG. *ēr*, Ger. *Erz*, bronze, AS. *ār*, Eng. *ore*, Skt. *ayas*, metal). The most abundant and useful of the metals. Unlike many of the common metals, iron is found only rarely in the native state, its occurrence being limited to meteorites which fall upon the earth from extra-terrestrial regions. Combined with oxygen and other elements, however, it is widely distributed as a constituent of rocks, and forms extensive deposits in many parts of the world.

Early History. Articles of stone, bronze, and iron have been found together on the site of the Swiss lake dwellings, but the most ancient specimens of iron at present known come from Egyptian and Assyrian ruins. There is in the British Museum a piece of iron taken from the Pyramid of Gizeh, which is believed to date from about B.C. 4000, and also an axe-head of Egyptian manufacture dating from B.C. 1370. Though the earliest pieces of iron now known came from Egypt, it is thought that probably the Assyrians were the first to use the metal freely in the manufacture of tools, weapons, and ornaments. Numerous samples of iron implements dating from B.C. 800, and including the fragment of a saw 44 inches long, were obtained from the ruins of Nimrud. In India, the famous iron pillar at Kutub, near Delhi, standing 22 feet above ground and weighing about 6 tons, dates from B.C. 400. It was made by welding disks of metal together, indicating a remarkable degree of skill on the part of those early iron-workers.

The Greeks were familiar with the uses of iron at least six hundred years before the Christian Era, although the metal was very scarce. It was not until the Roman Empire was fairly established that the use of iron became general over civilized Europe. The Romans made both wrought iron and steel, using the latter metal for swords and other edged implements. The ancient Britons, at the time of the invasion of Britain by Julius Cæsar, B.C. 55, were found to use swords, spears, hooks, and scythes of iron, indicating a familiarity with the metal for a considerable period previous. During the Roman occupation iron manufacture was vigorously developed, and in the succeeding Saxon age it seems also to have flourished. After the Norman Conquest little attention was paid to iron manufacture in England. In Germany, however, the art flourished vigorously, iron implements being exported to other countries in considerable quantities. Until about the middle of the fourteenth century all iron was produced by the direct process, the product being wrought iron or steel, as the case might be, according to the details of the process. About 1350, however, cast iron began to be made in Germany, and the beginning of the modern process of iron and steel manufacture was inaugurated.

The succeeding history of iron and steel manufacture will be continued in the article following under *Cast Iron, Wrought Iron,* and *Steel.*

Iron (symbol, Fe; atomic weight, 56), in the chemically pure state, is a silver-white metal that crystallizes in the isometric system. Its specific gravity is 7.84, and its melting-point between 1400° and 1500° C. (2500° and 2700° F.). It is the most tenacious of all the ductile metals, and it may be rolled into sheets so thin that the weight of a sheet of given size will be less than the weight of a sheet of paper of the same size. The magnetic properties are well known. Pure iron may be prepared by the prolonged action of a weak current of electricity on a solution containing pure ferrous sulphate and sal ammoniac or sulphate of magnesium, and heating the precipitated metal with a view of freeing it from 'occluded' hydrogen and diminishing its brittleness. Another method of obtaining chemically pure iron consists in preparing pure ferric hydroxide by adding ammonia to the solution of some pure iron salt, and then heating the hydroxide in a stream of hydrogen gas. Iron and platinum are the only metals that may be soldered together immediately, i.e. without the use of any soldering material. With mercury iron refuses to combine directly, the iron amalgam that has been used for electrical machines being made by a somewhat complicated process with the aid of the amalgam of sodium. When immersed in fuming nitric acid, iron becomes coated with insoluble oxide, and as it then refuses to dissolve in acids (unless the coating be removed), it is said to be in a *passive* state. Dry air or oxygen gas has no effect on iron. The 'rusting' of iron in ordinary atmospheric air is due to the presence of moisture; the fact that the rust thus formed is invariably found to contain ammonia would seem to indicate that iron reacts chemically with the moisture of the air, combining with its oxygen and setting free its hydrogen, which, in the nascent state, forms ammonia with the nitrogen of the air. Rusting may accordingly be prevented by covering iron with a waterproof coating or some paint or varnish, or with a coating of some metal like lead, tin, copper, nickel, or preferably zinc.

THE OXIDES OF IRON. With oxygen, iron forms three distinct compounds: Ferrous oxide, FeO; ferric oxide, Fe_2O_3; and ferric anhydride, FeO_3 or Fe_2O_6. When oxidized at high temperatures, iron yields the substance Fe_3O_4; but this is really a combination of ferrous and ferric oxides. *Ferrous oxide,* or rather ferrous hydroxide, $Fe(OH)_2$, may be obtained by adding caustic soda to a solution of green vitriol (ferrous sulphate). It is a white compound readily absorbing oxygen from the air, even if kept under water, and thus changing into ferric oxide; the oxidation causes its color to change gradually from white to green, gray, and brown. It is but sparingly soluble in water, the solution having an alkaline reaction. If boiled with a solution of caustic potash, ferrous hydroxide attacks the water of the solution, setting free its hydrogen and combining with its oxygen to form ferric hydroxide. *Ferric oxide,* in its anhydrous form, is found extensively as hematite. It is prepared artificially, by heating green vitriol, for use as an oil paint for wood, being known as *colcothar.* Ordinary *rouge,* which is used for polishing glass and metals, is artificial ferric oxide reduced to a fine powder. Ferric oxide may be obtained in the form of crystals having a dark-violet color, by heating green vitriol with common salt. If strongly heated, ferric oxide loses its property of readily dissolving in acids, and can then be dissolved only in strong acids and only at a high temperature. If heated to a white heat, it loses part of its oxygen and becomes converted into Fe_3O_4, which exhibits marked magnetic properties. The hydrate of ferric oxide, as ordinarily obtained by adding alkalies to solutions of ferric salts, has the composition $2Fe_2O_3.3H_2O$, and is readily soluble in acids. Another hydrate of ferric oxide has the composition $Fe_2O_3.H_2O$, and, like the anhydrous oxide, does not, if heated, readily dissolve in acids. By exactly neutralizing a solution of ferric chloride with alkali, and subjecting the resulting liquid to a process of hydrolysis, pure ferric oxide may be obtained in aqueous solutions. But, like other colloidal solutions (see COLLOIDS), that of ferric oxide is unstable, and the oxide readily passes from the soluble to the insoluble form. The hydrated forms of the oxide may be converted into the ordinary anhydrous form by the application of a moderate heat; at a certain point of this process, the substance suddenly becomes incandescent—showing that a peculiar molecular change is taking place in it—and after that it is found to have lost its property of readily dissolving in acids. The exact nature of the change is unknown. *Ferric anhydride* is unknown in the free state. It is the hypothetical anhydride of ferric acid, H_2FeO_4, which is likewise unknown in the free state, but certain of whose salts may be readily prepared. Thus, potassium ferrate, K_2FeO_4, may be obtained by heating small pieces of iron with the chlorate of potassium. From the existence of such salts it is evident that, much unlike ferrous oxide, which is distinctly alkaline in reaction, the peroxide of iron acts as a feeble acid. The tendency of peroxidized iron to pass into the stable ferric state is even greater than the tendency of ferrous iron to pass into that state, and hence the ferrates act as powerful oxidizers, readily burning such substances as oxalic acid, readily changing manganous oxide into manganese dioxide, etc.

THE SALTS OF IRON. Corresponding to ferrous oxide and ferric oxide, respectively, are two series of iron salts, ferrous salts and ferric salts.

The action of acids on metallic iron, in the absence of oxidizing agents, causes the formation of ferrous salts, among which deserve mention the sulphate, the sulphide, the chloride, and the oxalate. *Ferrous sulphate,* known as green vitriol, or iron vitriol, is the substance from which the compounds of iron are generally prepared. The sulphate itself is obtained as a byproduct in certain industrial processes, and may be prepared by the action of sulphuric acid on metallic iron. In its ordinary, hydrated form its composition corresponds to the formula $FeSO_4.7H_2O$. It has a greenish color that is scarcely perceptible when the salt is dissolved in water; the solution readily takes up oxygen, which causes the formation of ferric sulphate, and hence must be kept in sealed vessels out of contact with air, if it is to be preserved unchanged. Ferrous sulphate is used for a variety of purposes in the arts; it is employed in making fuming sulphuric acid, in dyeing, as a disinfectant, in making colcothar and rouge, etc. *Ferrous sulphide*, FeS, which has been found in many meteoric stones, may be made by heating iron filings with flowers of sulphur. It is largely used in chemical laboratories for the preparation of sulphureted hydrogen, which it yields on coming into contact with dilute sulphuric or hydrochloric acid. *Ferrous chloride*, or rather its hydrated form, $FeCl_2.4H_2O$, may be prepared by the action of hydrochloric acid on metallic iron. The crystalline anhydrous chloride, $FeCl_2$, may be prepared by the action of gaseous hydrochloric acid on red-hot iron. *Ferrous oxalate*, which is a powerful reducing agent, is used as a developer in photography, potassium-ferrous oxalate being used for the same purpose. Another important compound containing iron in the ferrous state is the well-known potassium ferrocyanide, or yellow prussiate of potash, which may be found described under HYDROFERROCYANIC ACID.

Among the ferric salts deserve mention the chloride, the sulphide, the nitrate, and the phosphate. *Ferric chloride*, Fe_2Cl_6, is a volatile and extremely hygroscopic salt prepared by the action of chlorine upon red-hot metallic iron. Its solutions in water have a brown color which may possibly be due not to the ferric chloride itself, but to the formation of basic chlorides of iron, which are eventually precipitated out of solutions of ferric salts. Commercial ferric chloride contains a considerable percentage of water, and hence contains basic chlorides, probably some free ferric hydroxide, etc. It is prepared by dissolving ordinary ferric hydroxide in hydrochloric acid. *Ferric sulphide*, FeS_2, occurs in nature abundantly as iron pyrite; it is used for the preparation of sulphurous anhydride in manufacturing sulphuric acid and in bleaching. *Ferric nitrate*, $Fe_2(NO_3)_6$, is obtained by dissolving metallic iron in an excess of cold nitric acid and allowing the solution to evaporate in a vacuum; the crystals thus obtained correspond to the formula $Fe_2(NO_3)_6.9H_2O$, and melt at 35° C. In aqueous solution, the nitrate gradually decomposes unless an excess of free nitric acid is present. *Ferric phosphate*, $FePO_4$, is an insoluble white substance formed when acid sodium phosphate is added to solutions of ferric acetate. Another compound containing iron in the ferric state, viz. potassium ferricyanide, may be found described under HYDROFERRICYANIC ACID.

MEDICINAL USES OF IRON COMPOUNDS. Iron itself and a number of its compounds are used in medicine in the form of various preparations; in the stomach all such compounds are converted into ferric chloride, and to a small extent into ferrous chloride. One of the best medicinal compounds of iron is ferric chloride, the evil effects of whose strongly acid properties may be avoided by the addition of bicarbonate of sodium. Another way to avoid the undesirable effects of acid compounds of iron is to administer them in the form of coated pills which may pass through the stomach unchanged, the acidity being then neutralized in the alkaline juices of the intestine. The constipating effect of iron compounds is well known, but is generally somewhat exaggerated; this effect may be readily avoided by the use of suitable purgatives. To avoid indigestion, iron compounds should not be taken shortly before or after meals. In the mouth, iron salts may (if acid) attack the enamel of the teeth, and by combining with sulphur (from food or the tartar of the teeth) form a black deposit of ferrous sulphide on the teeth and the tongue. For these reasons iron preparations are usually administered through a glass tube, and the mouth is to be carefully rinsed immediately after taking the dose.

Besides constituting the best-known local astringents for external application, iron salts are extensively used as a remedy for many forms of anæmia and the conditions caused by them, the best results being obtained by the use of ferrous sulphate and ferric chloride (the latter together with some glycerin). Iron salts have also been given with success in diphtheria, tonsilitis, and other forms of sore throat, as well as in erysipelas. In anæmia they have the effect of restoring the number of corpuscles and the normal amount of hæmoglobin in the blood. The fact that this takes place appears very remarkable in the light of a great deal of evidence which tends to show that no iron is actually absorbed into the system. We have seen above that in the stomach all iron salts are transformed into ferric chloride. On reaching the intestine the chloride is transformed into ferric hydroxide, and subsequently the latter is in turn transformed into the black sulphide and tannate of iron, which are voided with the fæces. All of the iron taken is thus voided, and none passes into the urine. On the other hand, when injected into the blood, even in very moderate quantities, iron salts produce symptoms of poisoning. The question therefore arises: In what manner do iron salts act in relieving anæmia? Definitely this question has not yet been answered. According to a theory advanced by Bunge, the iron normally present in the blood enters it in the form of complex organic iron compounds that are contained in food. That iron in some form or other necessarily enters the blood is evident, if we remember that the amount of iron in the body of a child increases with age. Now, according to Bunge, the alkaline sulphides that may be present in the intestines are capable of depriving the iron compounds of food of their iron, the resulting sulphide being of course incapable of absorption. But if sufficient quantities of iron are taken internally, the alkaline sulphides are decomposed and the organic iron of the food becomes available. The amounts of iron required depend of course upon the amount of alkaline sulphides in the intestines, and this is why it may be found necessary to administer as much as 18 grains a day to an anæmic woman whose body, in a normal state, contains altogether about 30 grains. A strong argument in favor of Bunge's theory of the indirect action of iron is found in the fact that manganese, copper, and certain other substances not at all present in the blood are almost as efficient as iron in curing anæmia.

Ferric chloride, the most important medicinal salt of iron, is usually administered in the form of its tincture, which contains about 3.25 per cent. of iron, corresponding to about 9.5 per cent. of anhydrous ferric chloride. The tincture is prepared by making up 250 parts of the official aqueous solution of ferric chloride to 1000 parts with alcohol. *Ferric hydroxide with magnesia* is known as 'arsenic antidote,' being an effective remedy for poisoning with arsenic. The antidote may be best prepared by gradually adding 10 parts of magnesia in water to 50 parts of ferric hydroxide in water, and shaking the mixture vigorously. It should be prepared immediately before using, and should be given repeatedly in large doses. Iron salts should never be given together with any preparation containing tannic or gallic acid.

IRON ORES.

The minerals which are commercially important as sources of iron may be grouped in the following classes: (1) *Magnetite.*—This class includes ores in which the iron occurs as magnetic oxide (Fe_3O_4); they contain when pure 72.40 per cent. of iron. (2) *Hematite.*—All varieties that are sesquioxides (Fe_2O_3), with 70 per cent. of iron. They are variously known as red, blue, and specular hematites, also as micaceous and fossil ores, according to their color and physical structure. (3) *Limonite.*—The hydrated oxides ($2Fe_2O_3 3H_2O$), including bog ores, pipe ores, etc., with 59.89 per cent. of metal. Brown hematite is a synonymous term for limonite. (4) *Siderite.*—Ores containing carbon dioxide and represented by the type formula ($FeCO_3$), with 48.27 per cent. of iron. Spathic ore is another name for siderite, while clay ironstone is a term applied to the varieties containing much clay and having a concretionary structure. When the ore contains bituminous matter in addition to clay it is called blackband.

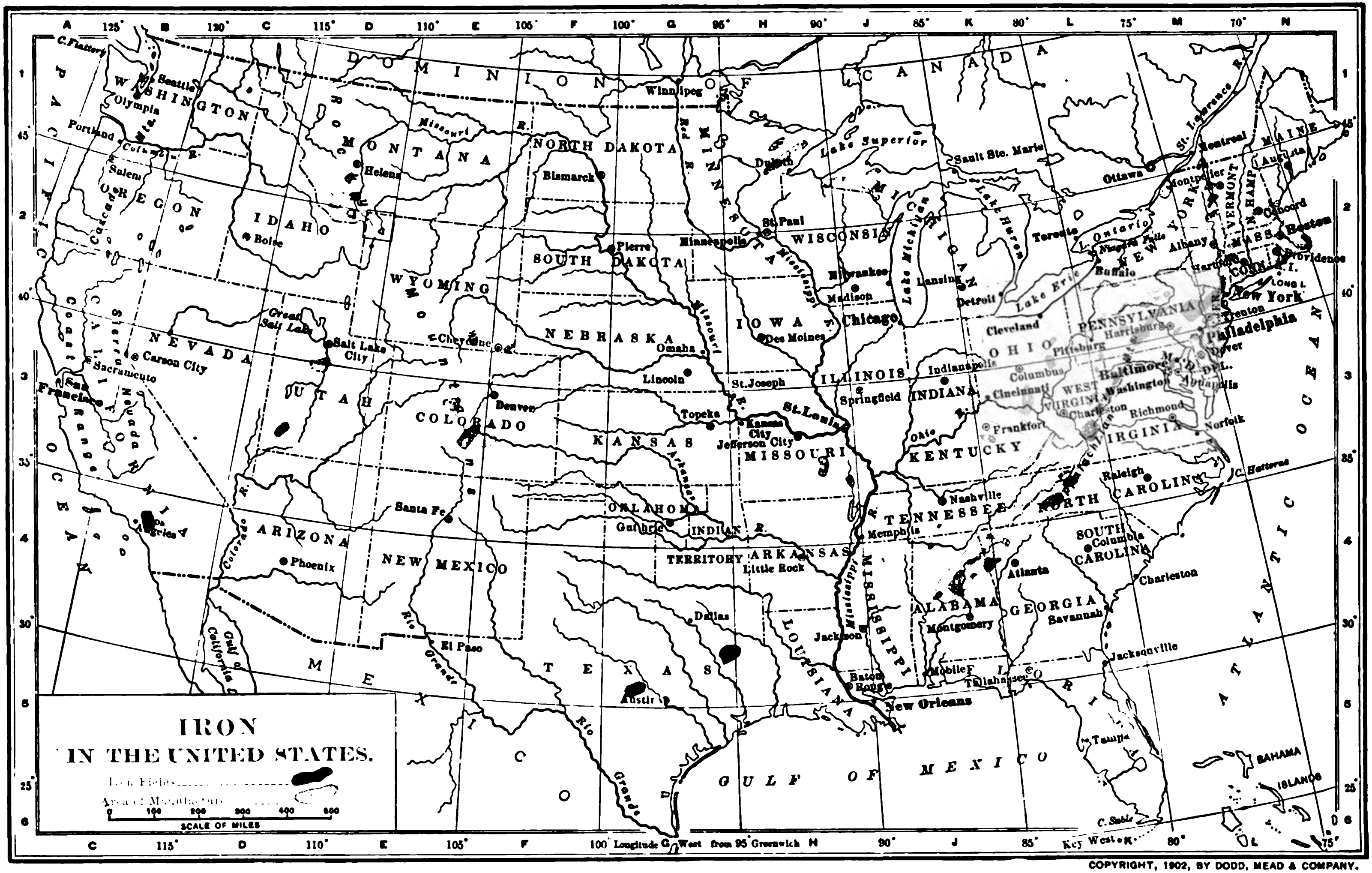
Pyrites (FeS_2) and franklinite, an oxide of iron, manganese, and zinc, are utilized to a very small extent. Pyrites is first roasted for the recovery of sulphur in sulphuric acid manufacture, and the clinker is then smelted. Franklinite is employed in the production of spiegeleisen, after extracting the zinc by roasting.

COMPOSITION. The ores of iron always contain more or less foreign matter, and only approximate the metallic content required by the chemical formulæ; the discrepancy commonly amounts to 10 per cent. or more. As the costs of handling and treatment per ton of iron are indirectly proportional to the purity of the ores, the higher grades are naturally in most demand. In the United States mining is confined practically to the hematite, limonite, and magnetite deposits, which on the average carry from 50 to 60 per cent. of iron, while elsewhere ores may be worked that run as low as 30 per cent. The nature of the impurities is of great importance in determining the value of ores. The common impurities are those which enter largely into the composition of the rocks surrounding the deposits. They are silica (SiO_2), alumina (Al_2O_3), lime (CaO), magnesia (MgO), water (H_2O), and carbon dioxide (CO_2). Water and carbon dioxide are objectionable only as they replace the iron, while the others exert an influence upon the fluxing properties of the ore and the course of smelting operations. Of greater importance, however, are the small quantities of phosphorus, sulphur, and titanium, these impurities being almost wholly obnoxious in their effect. Phosphorus gives a fluid pig iron that can be converted into steel only by employing special methods of treatment. As a large part of the iron produced is now converted into steel by the acid Bessemer process, which does not eliminate phosphorus, ores adapted to this treatment find a ready market at good prices. For such ores the outside limit of phosphorus relative to the iron is $\frac{1}{1000}$; that is, an ore carrying 60 per cent. of iron is not of Bessemer grade unless the phosphorous content falls below 0.06 per cent. In the United States common practice fixes a still lower limit for phosphorus.

RESOURCES OF THE UNITED STATES. The relative importance of the different iron ores mined in the United States is shown by the following percentages of the total output for 1901: Hematite, 83.1; limonite, 10.4; magnetite, 6.3; siderite, 0.2 per cent. Hematite thus contributes more than four-fifths of the total production. A large part of this ore comes from the Lake Superior region, where immense deposits have been found in metamorphosed Pre-Cambrian rocks. Five productive belts, or 'ranges,' as they are commonly called, are known. The Marquette range, opened in 1856, is situated in Michigan, east of the Keweenaw Peninsula. The Menominee Range, first developed in 1877, lies on the border of Wisconsin and the upper peninsula of Michigan; it is succeeded farther westward by the Gogebic Range, which was opened in 1884. The Vermilion and Mesabi ranges are situated northwest of Lake Superior, in Minnesota; they were first exploited in 1884. The deposits are found near the surface, and operations are conducted on a large scale. In some cases the ore is excavated, after removing the overburden, by steam shovels, which deposit it directly in the cars. A single mine in Minnesota has produced 1,681,000 long tons of ore in a year, or more than the annual output of the entire country prior to 1854. The total production of the Lake Superior mines up to and including 1901 was 192,008,000 long tons. The bulk of the ore is forwarded by rail to ports on Lakes Superior and Michigan, and thence shipped by boat to Chicago and Lake Erie ports, a large proportion being destined for the manufacturing centres of western Pennsylvania. A great shipping industry is engaged in the transport of Lake Superior ores, and it is largely owing to this fact that the tonnage of vessels passing through the Sault Sainte Marie Canal each year exceeds the annual commerce of the Suez Canal.

Hematite ores are also mined in many of the Appalachian and Rocky Mountain States. The Clinton formation of the Silurian, which outcrops along the western slopes of the Appalachians from New York to Alabama, contains valuable deposits interstratified with shales and limestones. Some ore is obtained at Clinton, N. Y., and near Chattanooga, Tenn.; but the most productive beds are in the Birmingham district of Alabama.

The limonite or bog ores are widely distributed, although, owing to their low iron content, they are worked extensively in only a few regions. Virginia, Alabama, Tennessee, and Colorado produce the largest quantities of limonite. Magnetite occurs in the Adirondacks, the New Jersey Highlands, near Cornwall, Pa., and in many of the Western States. Siderite is asso-



IRON
IN THE UNITED STATES.

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ciated with the coal measures of Ohio and Pennsylvania.

The total production of iron ores in the United States in 1901, according to the *Mineral Resources*, was 28,887,479 long tons. This output was distributed among the leading States as follows: Minnesota, 11,109,537 tons; Michigan, 9,654,037 tons; Alabama, 2,801,732 tons; and Pennsylvania, 1,040,684 tons. The imports for the same year were 966,950 tons, more than one-half of which came from Cuba.

FOREIGN COUNTRIES. The iron ores of Great Britain include siderite, limonite, and hematite. The Cleveland district is the most important, and produces siderite averaging 30 to 40 per cent. in iron from deposits in the coal measures. Limonite is mined in Lincolnshire, Northamptonshire, and Leicestershire, and hematite in Lancashire and Cumberland. As the domestic supply of ore is insufficient, large quantities are imported from Spain, Sweden, Greece, and other countries. Germany has iron-mines in Alsace-Lorraine, Westphalia, and Hesse-Nassau, and the Grand Duchy of Luxemburg is noted for its iron. The ores are mostly limonites and hematites, and carry from 30 to 50 per cent. of iron. France, Spain, Sweden, Austria-Hungary, and Russia complete the list of the important producers. Canada has given much attention in recent years to the development of her iron industry, with results that promise well for the future. Large blast-furnaces and steel-works were completed in 1901, which utilize hematite and magnetite ores from Newfoundland, Nova Scotia, and Ontario.

IRON, RALPH. The pseudonym of Olive Schreiner (q.v.).

IRON AND STEEL, METALLURGY OF. In some cases the ores of iron can at once be treated in the blast-furnace without preparation of any kind. In all cases the preliminary treatment must be simple and cheap, in order to be commercially practicable. The common methods of preparing iron ore for the blast-furnace are the following: Sorting and sizing consists in roughly separating the ore from the barren rock and other fragmentary impurities, and then grading it into lumps of similar size to promote regularity in smelting. Washing consists in removing clay and other earthy matter from the ore by means of water; both hand washing and mechanical washers are employed. Magnetic concentration consists in passing naturally fine ores, or ores made fine by crushing, through so-called separators, in which the ore is drawn from the nonferrous gangue by means of magnetized drums or other mechanism. Weathering consists in stacking the ore in heaps to remove shale and sulphur, which crumble or wash away under the action of the elements. Calcination consists in treating the ores to drive off volatile matters, usually water, carbon dioxide, sulphur, and carbonaceous matter, or to oxidize the ore. Calcination may be accomplished by washing the ore in open heaps or by heating it in calcining kilns. Sometimes a combination of two or more of the methods of preparation previously described is employed.

CAST IRON. As stated under IRON, cast iron was first produced in Germany. Previous to about 1350 the highest temperatures obtainable in the blast-furnace had been barely sufficient to produce a pasty bloom of iron which then had to be hammered to remove the cinder and forged into shape. During the early part of the fourteenth century, however, German iron-makers, in their endeavors to reduce the cost of manufacture, began to build blast-furnaces of gradually increasing size, from which, by allowing the metal to remain longer in contact with the fuel, iron was obtained in a molten condition capable of being readily cast into any desired shape. At once the founding of iron became an important art. It was not long, however, before the fact was established that by further treatment the cast iron would be transformed into wrought iron. To-day the production of cast iron in the blast-furnace is the first step in the manufacture of iron and steel.

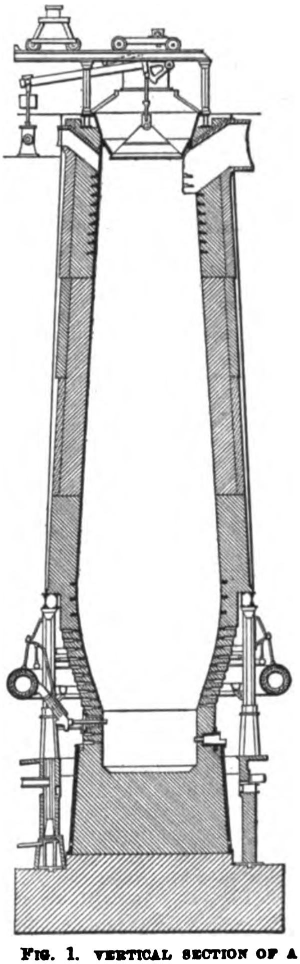


FIG. 1. VERTICAL SECTION OF A BLAST-FURNACE.

With the discovery of cast iron and the introduction of its manufacture into England, the British iron trade, which had lain dormant, began to revive, and at the end of the sixteenth century it had assumed very considerable proportions. At first charcoal was the fuel used in the blast-furnace, and this fact resulted in such depletion of the timber-supply that several acts of Parliament were passed between 1558 and 1584 restricting the number and position of iron-works and prohibiting the construction of new works in certain districts. A decline in iron manufacture was the natural result.

Naturally, also, attention was turned to the possibility of some substitute for charcoal. This was discovered about 1619 by Dud Dudley, who produced coke from pit coal, and successfully used it for smelting iron in the blast-furnace. The substitute did not gain favor, for various reasons, which it is needless to mention further than to say that they were not lack of success in the use of coke.

During all of the seventeenth century charcoal remained the almost universal fuel for blast-furnaces. These furnaces were small and widely scattered; they had a capacity of about 20 tons of cast iron per week each, were built of masonry, and the blast was supplied by bellows operated by water-power. In 1713 Abraham Darby, of Coalbrook Dale, in Shropshire, revived the use of coke fuel for blast-furnaces, and after much labor succeeded about 1740 in making a success of it. The use of coke now spread rapidly; and this, with the development of the steam-engine for blowing purposes and for supplying power to mills and forges, gave an enormous impetus to iron manufacture.

No further improvement in blast-furnace practice occurred until 1828, when J. B. Neilson, an Englishman, brought forward a proposition to heat the air for the blast. The greatly increased output which resulted from the use of the hot blast set on foot a series of improvements in blast-furnace construction. These improvements took the form of increased dimensions and capacity of the furnace and of the use of an increased number of tuyeres; the stove for heating the blast air was improved, more efficient and powerful blowing engines were employed, apparatus for hoisting the ores, fluxes, and fuel, and for charging them into the furnace were introduced, and a great variety of minor improvements were made. Until 1880 British furnaces led the world in size and output; but about this time American iron-makers began to take the lead in these respects, and have maintained it ever since. A few figures selected at random will show the progress of growth in blast-furnace dimensions, capacity, and output: 1855 to 1861, height 30 feet, capacity 2000 cubic feet, output 200 tons weekly; 1882 to 1885, height 70 feet, capacity 8200 cubic feet, output 800 tons weekly; 1892 to 1895, height 90 feet, capacity 18,200 cubic feet, output 2500 tons weekly; 1900, height 100 feet, capacity 24,000 cubic feet, output 600 tons every 24 hours. At this point it may be noted that the first iron-furnace in America was a bloomery erected in Virginia in 1619, and the first blast-furnace with a forced blast was built about 1714 in the same State. Shortly after the Revolutionary War numbers of charcoal-furnaces were working. From this time on the growth of iron and steel manufacture in America was rapid, until in 1890 the United States took first place among the iron-working nations of the world.

The internal shape and general construction of a modern American blast-furnace are shown by Fig. 1. As will be seen, the structure resembles in shape the common glass lamp-chimney. The cylindrical portion at the bottom is called the hearth, the bellying portion next above is the boshes, and the conical portion above forms the stack. The general construction is a masonry lining within a steel shell. To keep the hearth cool it is surrounded by a water-jacket. Air is supplied by tuyeres drawing from a circular blast-main. At the top there is a funnel-shaped charging hopper closed by a conical door and suitable exits for the furnace gases. These gases pass down through metal pipes to the stoves for heating the blast. Blast pressure is supplied by blowing engines which draw in cold air and discharge it through the hot-blast stove, whence it passes into the blast-mains and then through the tuyeres into the furnace. The furnace is charged by means of a car carrying a suspended skip, which is hauled up an incline to the top of the furnace and then discharged into the charging hopper. While the foregoing description applies to a particular furnace, it will serve in a general way for all blast-furnaces.

In operation a blast-furnace is charged at the top with approximately alternate layers of ore, limestone, and fuel, usually coke. At the bottom of the furnace is introduced a current of hot air through the tuyeres. The materials introduced into the furnace, therefore, form two currents moving in opposite directions, one current being composed of hot gases and the other of solid substances. The chemical reactions which take place between these two currents result in the production of molten iron, molten slag, and gases. These reactions are of very complex nature, and can only be indicated in a general way. When the highly heated blast enters the furnace the carbon of the fuel burns with the oxygen of the air to form carbon dioxide; this, at the high temperature prevailing in the hearth, is almost immediately dissociated, and the liberated oxygen combines with more carbon to produce carbon monoxide. Carbon monoxide, being a powerful reducing agent, takes oxygen from the ore to produce carbon dioxide. When the iron ore is charged into the furnace it at first suffers no chemical change, but gradually absorbs heat until at a temperature of about 200° C. it begins slowly to lose oxygen. As the temperature rises and the materials descend in the furnace the reduction becomes more rapid until at 600° C. it is very rapid. At this temperature also the limestone decomposes, forming quicklime and liberating carbon dioxide, part of which takes up carbon from the fuel-producing carbon monoxide. When the charge has passed through about 30 feet of the stack it has been deoxidized, and consists of lumps of spongy iron, side by side with pieces of coke and quicklime. The descent of the charge continues for 30 or 40 feet without much change, until a temperature sufficient for the formation of slag has been reached, when the silica and other bases combine with the lime to produce slag. The charge then melts and runs down into the hearth, and collects below the level of the tuyeres in two layers, one of molten iron at the bottom and the other of molten slag on top.

The next step is to tap the furnace and draw off, first the molten slag, and then the molten metal. Generally the slag is run to waste, but sometimes it is preserved and submitted to treatment which permits its utilization. Some of these uses are road metal, railway ballast, slag bricks, slag wool, and hydraulic cement. Bricks are made by casting the molten slag in molds. To produce slag wool the molten slag is blown by a jet of steam, which produces small globules, to each of which is attached a long thin filament. (For the utilization of slag in cement-making, see CEMENT.) Slag, whatever use may be made of it, is only an incidental product; the essential thing is to secure the molten iron in suitable form for use. To do this the molten iron is run into molds, which produce cast ingots or bars called pigs.

Formerly the casting was performed entirely in sand molds formed in the casting floor; but at present the largest and best equipped blast-furnace plants employ casting machines. In casting in sand molds, these molds of trough shape are formed thickly over the casting floor; the iron from the furnace flows into a large main channel, thence into side channels, and thence into the individual molds, until a part or all of them are filled with molten metal. This is allowed to solidify, and then the pigs are removed and the molds prepared for another set of pigs. In pig-casting machines two endless chains carry a series of pressed-steel molds, which travel at slow speed past a trough terminating in two mouths. The molten iron from the furnace is tapped into a ladle, which is carried by a ladle-car into position to discharge into the double-mouthed trough. As each mold passes it is filled with molten iron. The endless chain of molds as it moves along descends under a tank of water, where the molten metal cools and hardens. The cooling is continued by sprays of water as the molds ascend from the water and move on toward the tail sheaves, where the pigs are discharged onto cars. The casting machine of one of the most recent American blast-furnace plants has a chain travel of 20 feet per minute, the molds are spaced 1 foot apart on the chains, and the machine delivers 20 pigs per minute averaging in weight 110 pounds each.

In the preceding description of the blast-furnace process of producing cast iron the attempt has been made to avoid confusion by subordinating the accessory details of furnace equipment and operation to the main narrative. Some of these matters deserve further mention. The essential accessories to the blast-furnace in the nature of a working plant are the blowing engine, the hot-blast stove, and the material hoist. The older and less-used form of blowing engine is the beam engine, the steam-cylinder being connected to one end of the beam, and the air or blowing cylinder to the other. The present form of blowing engine is either a vertical or a horizontal direct-acting engine, the former being the more common type. Very often the steam end of the engine is compound. Until very recently steam blowing engines have been used almost exclusively, but in Europe considerable progress has been made within the last few years in the adoption of gas-engines (q.v.) operated by blast-furnace gas. In America a separate engine is generally provided for each furnace, but in Europe one engine commonly supplies air to two or more furnaces. The blast pressure provided by blowing engines in actual working varies from 5 pounds to 14 pounds per square inch, American iron-makers favoring the higher pressure.

The first form of hot-blast stoves were all heated by solid fuel. About 1860 E. A. Cowper, an Englishman, applied the regenerative method of Siemens to heating the blast with waste furnace gases. The Cowper stove, or modifications of it, are now extensively used. Two stoves are required for each furnace. Briefly described, each stove consists of an outer shell of steel plates lined with fire-brick to form a vertical cylinder with a dome-shaped top. A circular flue extends from the bottom to the top of the stove, and the remainder of the space is filled with special-shaped fire-bricks which form a honeycombed or cellular filling. Hot gases from the furnace are discharged into the bottom of the vertical flue, where they meet the air-inlet and combination takes place. The burning gases pass up the flue and thence down through the cellular filling to an outlet leading into the chimney. In passing through the cellular filling the gases heat the brick to a red heat. When this is accomplished the gases are shut off by means of suitable valves, and by opening other valves the cold blast from the blowing engine is passed through the stove in the direction opposite to that taken by the heating gases, and thence through the tuyeres into the furnace, being highly heated in the passage. Meanwhile the gases diverted from the first stove are being passed through the second stove and are heating it; that is, one stove is absorbing heat while the other is heating the blast. Sometimes a third stove is supplied to be used in case of accident to one of the others. The Whitwell stove is another popular form. It is a cylindrical sheet-steel, fire-brick lined structure like the Cowper stove; but the interior construction consists of a series of vertical fire-brick passages through which the hot gases and blast-air pass alternately up and down, but in opposite directions. The operation of the Whitwell stoves is similar to that of the Cowper, one receiving heat from the furnace gases while the other is heating the blast. Several combinations and modifications of the Cowper and Whitwell stoves are in use.

The material hoist is a necessary adjunct to the modern blast-furnace, where hundreds of tons of coke, ore, and limestone have to be raised daily 100 feet or more to the charging hopper. These hoists are operated by hydraulic, pneumatic, or steam power, and in general consist of an elevator cage or corresponding apparatus on which the material cars may be raised and lowered. In the furnace illustrated the cars are hauled up and down an inclined plane. These hoists are arranged to work as nearly automatically as possible. Among the other appliances necessary to the operation of a modern blast-furnace are pumping engines for supplying cool water to the hearth-jacket and to the cooling rings and for other purposes; dust-catchers for separating the dust from the furnace gases previous to their utilization in the hot-blast stove, or for other purposes; the tuyeres; apparatus for tapping the furnace; ladles of various kinds, etc.

A few words may now be said regarding the fuel and fluxes used in blast-furnace smelting. As has been said already, charcoal was the fuel originally employed. At present but few charcoal furnaces are in operation, but the iron produced from them is of the best quality, and is much used for special purposes. Coke is the fuel most extensively used, and its manufacture is fully described in the article COKE. Next to coke, coal is the most commonly used fuel. Attempts have been made in a few instances to use gaseous fuel, but they have met with little success. The flux universally used in smelting iron is limestone. The purpose and action of this flux has been explained briefly in describing the chemical reactions which take place in the blast-furnace.

PROPERTIES OF CAST IRON. The product of the blast-furnace, as already said, is cast iron. As this is the preliminary form of practically all iron for making both wrought iron and steel, its properties require a brief description. Cast iron consists of metallic iron combined with at least 1½ per cent. of carbon and smaller percentages of silicon, sulphur, phosphorus, and manganese; the elements other than metallic iron being about

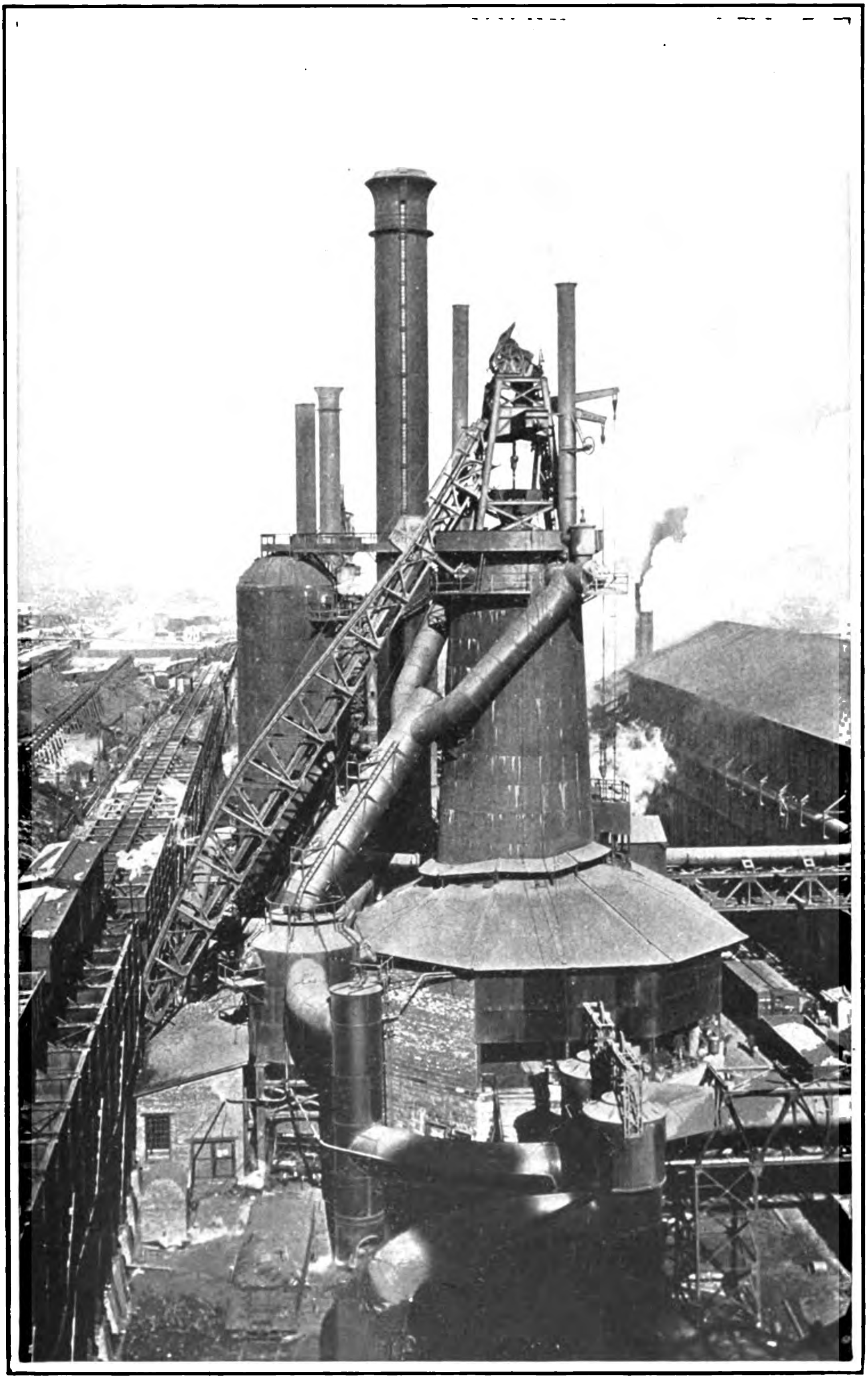
7 per cent. of the whole, though this percentage may vary considerably. Cast iron melts at about 1200° C., and when cold is hard and brittle. It is not malleable or ductile, and cannot be tempered. Of the several elements named, carbon and silicon are of value in steel-making, which is the chief purpose for which cast iron is produced at the present time; but sulphur and phosphorus are generally highly objectionable. In using the term cast iron here, the chemical nomenclature has been retained. The foundryman generally gives the name *pig iron* to the direct product of the blast-furnace, and the term *cast iron* to the form which pig iron assumes after remelting. For commercial purposes pig iron is graded into several classes, according to the appearance of the fracture. This is an unscientific and unsatisfactory method of grading, but it is the one almost always adopted. The different grades are given different names, and these names vary in character and significance in different countries. In the United States the more common grades are: No. 1 Foundry, No. 2 Foundry, No. 3 Foundry, No. 1 Soft, No. 2 Soft, Silver Gray, Gray Forge, Mottled, and White. These grades vary in chemical composition, and it is being urged by many prominent metallurgists that chemical composition be substituted for the appearance of the fracture in distinguishing between different grades of iron.

Wrought Iron. The iron made by the ancients, and, indeed, by all peoples up to 1350, when cast iron was first produced in the German blast-furnaces, was wrought iron, and it was produced from the ore in a single operation. To-day wrought iron is nearly always obtained by treating pig or cast iron made in the blast-furnace, and the process is said to be 'indirect,' as compared with the 'direct' process of the ancients. The direct process is still employed by all savage races who make iron, and is also in use where the character of the ore, the fuel, or other conditions make the adoption of the blast-furnace impracticable. A few forms of the direct process will be described here. The ancients employed small hearths, the fuel used being charcoal and the necessary draught being obtained either by means of rude bellows or by arranging the hearth at the top of a gully or channel in such a manner as to take advantage of the prevailing wind. Such hearths are now used in Africa and some parts of India by the natives. A modification of the hearth process once extensively used in Southern Europe, but now extinct, was the Catalan process, the name being derived from the Province of Catalonia, in Spain, where the process was probably first employed. This process is chiefly notable because of the form of water blower used, which was called a *trompe*. See Blowing Machines.

A more important hearth process was the *American bloomery* process, much resembling the Catalan process, but showing an advance in the use of more modern blowing machines with hot blast, and in the provision of means for cooling the furnace walls by water. The three processes described were hearth processes. A more common form of the direct process consists in the use of blast-furnaces. These furnaces are insignificant in size, as compared with modern cast-iron blast-furnaces; the smaller ones are from 4½ to 6 feet in height, while the largest seldom exceed 10 feet in height. These furnaces are extensively used by the natives of India, who produce an excellent quality of iron in them. The two modern forms of the direct process are the retort process and the reverberatory furnace process. In the retort process, of which there are several forms, the ore, reduced to a fine division, is placed in the heating chamber with charcoal or other carbonaceous matter, and is heated either by the external fire or by means of gaseous fuel, the products of combination of which are made to pass through the charge. In the reverberatory-furnace process fine ore and coke are reduced in a reverberatory furnace by gaseous fuel. In all of these processes thus far mentioned the direct product of the furnace is a spongy mass of metallic iron and slag, which has to be squeezed or hammered to remove the bulk of the cinder.

The preceding brief review of the direct process of producing wrought iron may be summed up by saying that at present there is no direct process known which is capable of competing for a lengthened period and on a broad scale with the indirect process. The manufacture of wrought iron from cast iron by this process is accomplished by purification. This further purification is always carried out by means of oxidation, though the details of the process vary according to whether the necessary oxygen is supplied chiefly from the atmosphere or from other materials added for the purpose, and also as to whether the iron to be purified is heated in a separate furnace or chamber from that in which the fuel is burned, or in direct contact with the fuel. The furnaces used may be divided into two classes—(1) hearths and (2) reverberatory furnaces. In hearths the fuel is burned in direct contact with the iron, and the chief source of oxygen is the atmosphere; in the reverberatory furnace the oxygen is obtained from special oxidizing materials added for the purpose, and the fuel is burned in a chamber separate from, but communicating with, the chamber in which the charge is placed. With this outline of the methods of producing wrought iron from cast iron, attention will be turned to the process which is chiefly employed.

The chief impurities to be removed from cast iron to make it into wrought iron are silicon, manganese, phosphorus, and carbon. To remove these by the puddling process, a special puddling furnace is employed. These furnaces are of various forms, but the ordinary form is a single-bedded reverberatory furnace. Briefly described, such a furnace consists of a combination chamber of oblong shape. At the front of this chamber are the grate-bar, to the rear of which rises a vertical wall, and back of this, at a higher level than the grate-bars, is a shallow receptacle for the charge. A common roof covers the two chambers. This roof is horizontal over the grate-bars, but curves downward as it extends backward until at the flue-entrance it descends below the level of the charge. There are two doors at the side, one for feeding the fire and the other to give access to the charge. Structurally the furnace consists of cast-iron plates and fire-brick. In operation the combustion of the fuel takes place on the grate-bars, and the hot gases and flames rise to the roof and are beaten back or reverberated upon the charge as they move toward the flue. Generally two men work at a furnace. The puddling process consists of four



A MODERN BLAST FURNACE
Blast Furnace of Colorado Fuel and Iron Company at Pueblo, Colorado. Capacity, 600 Tons.

stages. Previous to describing these stages it will be necessary to state briefly the manner of preparing the furnace for work. The basin for the charge is made of cast-iron plates. These are covered with a layer of oxidizing material a few inches deep, and the fire is then started and urged until the heat is intense enough to partly fuse this material and the fragments cohere. The sides of the basin are banked up with similar material. Slag is then shoveled in, and the pig iron to be treated is placed in this couch of slag. The lining of the basin lasts for many successive charges, with occasional repairs as wear occurs.

The furnace having been charged, the door is closed, and rendered as nearly as possible air-tight by banking with cinder. Heating is continued until the top of the pig iron is red hot, when it is turned by opening the door, which is afterwards closed until the iron melts, the workmen stirring up the mass with a rod at intervals to hasten the process. This completes the melting-down stage. One of the workmen next introduces a hooked bar and vigorously stirs the molten mass until its appearance to his skilled eye indicates that the silicon has been expelled. This completes the second or clearing stage. The next process is to reduce the temperature, and vigorously continue stirring until the metal and cinder become thoroughly mingled, part of the slag flows off, and the metallic iron and residue of slag form a porous cake in the melting basin. This completes the third stage, known as the boil. The final stage is to break up the porous cake, and form the separate parts into balls by manipulating them with a bar. These balls are taken from the furnace and hammered or squeezed to press out the slag, when the iron is ready to be manufactured. During these various stages of the puddling process the impurities of the cast iron (silicon, manganese, phosphorus, and carbon) are removed. As previously stated, various forms of puddling furnace are used, and other variations in apparatus and methods employed; but the general process is always essentially as described.

The crude puddle ball which is drawn from the furnace is composed of innumerable globules of nearly pure iron, the interstices between which are filled with slag. Much of this slag is removed in squeezing, and each subsequent working removes a further quantity, but it is never all removed. The piece of iron made in the first rolling of the puddle ball is a rough, crude product known as muck bar. To make merchant iron several of these muck bars are bundled together into 'piles,' so as to give a bloom of proper sectional area, and this after being heated to a welding heat is rolled into the desired shape. See ROLLING-MILL.

STEEL. As has been noted, steel was manufactured at a very early date in the history of civilization. Prior to 1856, however, it was produced in comparatively small amounts, and its use was restricted to the production of cutlery and tools. In 1856 Henry Bessemer made known the process for making steel in large quantities which revolutionized the iron trade of the world. This was followed by the inventions of Siemens, Martin, and Thomas, which gave a further impetus to steel manufacture, and widely extended the use of that material. At present steel is made by the cementation process, by the crucible process, by the acid Bessemer process, by the basic Bessemer process, by the acid open-hearth process, and by the basic open-hearth process. In the following paragraphs each of these processes will be described in outline.

Cement steel is made by placing a bar of soft, pure wrought iron in fine charcoal and exposing it to yellow heat. By a slow process called cementation the carbon penetrates the metal at the rate of about one-eighth inch every twenty-four hours. The process of cementation is carried on in large retorts which handle many tons of bars at one time, so that it will always happen that some parts of the furnace arrive at full heat much sooner than others, and remain longer at that temperature. The consequence is that it is necessary to break all the bars and grade the pieces by fracture according to their degree of carburization. Steel made in this way is commonly known as blister steel. Its use is limited by the fact that it always contains seams or pits of slag, which are present in the wrought iron. To avoid this trouble cement steel may be melted in a crucible out of contact with the air, and, being thus free from the slag, can be cast into ingots and hammered or rolled into any desired shape. This double process is expensive, and a cheaper and more common method of making crucible steel is to place powdered charcoal and crude bar iron in the crucible, the iron absorbing the carbon very rapidly in the molten state. This practice is almost universal in America. Sometimes pig iron and wrought iron are melted together, and in Sweden crucible steel is produced from pig iron and iron ore. Both blister steel and crucible steel belong to the general class known as high-carbon steel. Such steel can be made regularly in open-hearth furnaces; but so far this method, though cheaper, has not replaced the older methods. Blister and crucible steel are chiefly used for high-class edged tools, springs, etc.

BESSEMER PROCESS. The most common steel-making process is the Bessemer process, which may be subdivided into the acid Bessemer and the basic Bessemer process. The apparatus used is the same for both the acid and the basic process, and the general process is the same up to a certain point. The chemical reactions differ substantially, however. Briefly described, the Bessemer process consists in charging molten pig iron into a vessel called a converter, forcing a blast of air through it until the silicon, manganese, and carbon are burned out, and restoring a definite portion of manganese and carbon by adding a recarburizing material. This is the process in skeleton; it divides itself for the purpose of a detailed consideration into the following divisions: Apparatus and mechanical manipulations and chemical reactions.

The central feature of the plant for making Bessemer steel is the converter. This is a pear-shaped or jug-shaped vessel of steel, lined with a refractory material. Fig. 2 shows a modern American Bessemer converter in cross-section. The vessel is mounted on a horizontal axis, consisting of two hollow gudgeons, through which the air-blast enters the bottom of the converter. An automatic valve shuts off the air when the converter is turned on its side, and admits it when the converter is upright. The blast is furnished by a blowing engine which keeps the pressure at from 25 pounds to 30 pounds per square inch. The converter lining is about one foot thick, and consists of a siliceous composition or stone in the acid process, and of dolomite or limestone in the basic process. The converter is so equipped that it can be rotated from a vertical to a horizontal position and back in either direction. In operation the molten pig iron is charged into the converter when it lies horizontal. When the molten metal is taken directly from the blast-furnace it is usually brought to the converter in ladles; but in case the iron is melted in cupola furnaces these are so placed that they discharge directly into the converter. As soon as the charge has been run into the converter it is turned into an upright position, the operation automatically turning on the blast. The blowing continues from seven to twelve minutes, and then the converter is turned upon its side and the recarburizing material in molten form is added. The charge is then ready for casting. This operation consists first in drawing the contents of the converter into a ladle, which is swung into position under the nose of the converter by a crane, the converter being tipped so as to empty. Sometimes the molds are set in a row around the perimeter of a circular pit, and the ladle is swung around in a circle by the crane to fill one mold after another; but more often, in American practice, the molds are mounted on little platform cars which are hauled past the ladle and filled one at a time, the same cars taking the filled molds to the rolling-mill, where they are stripped from the ingots. Practically all the mechanical operations, like the tilting of the converter and ladles, are performed by power.

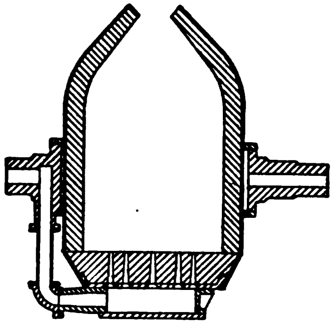
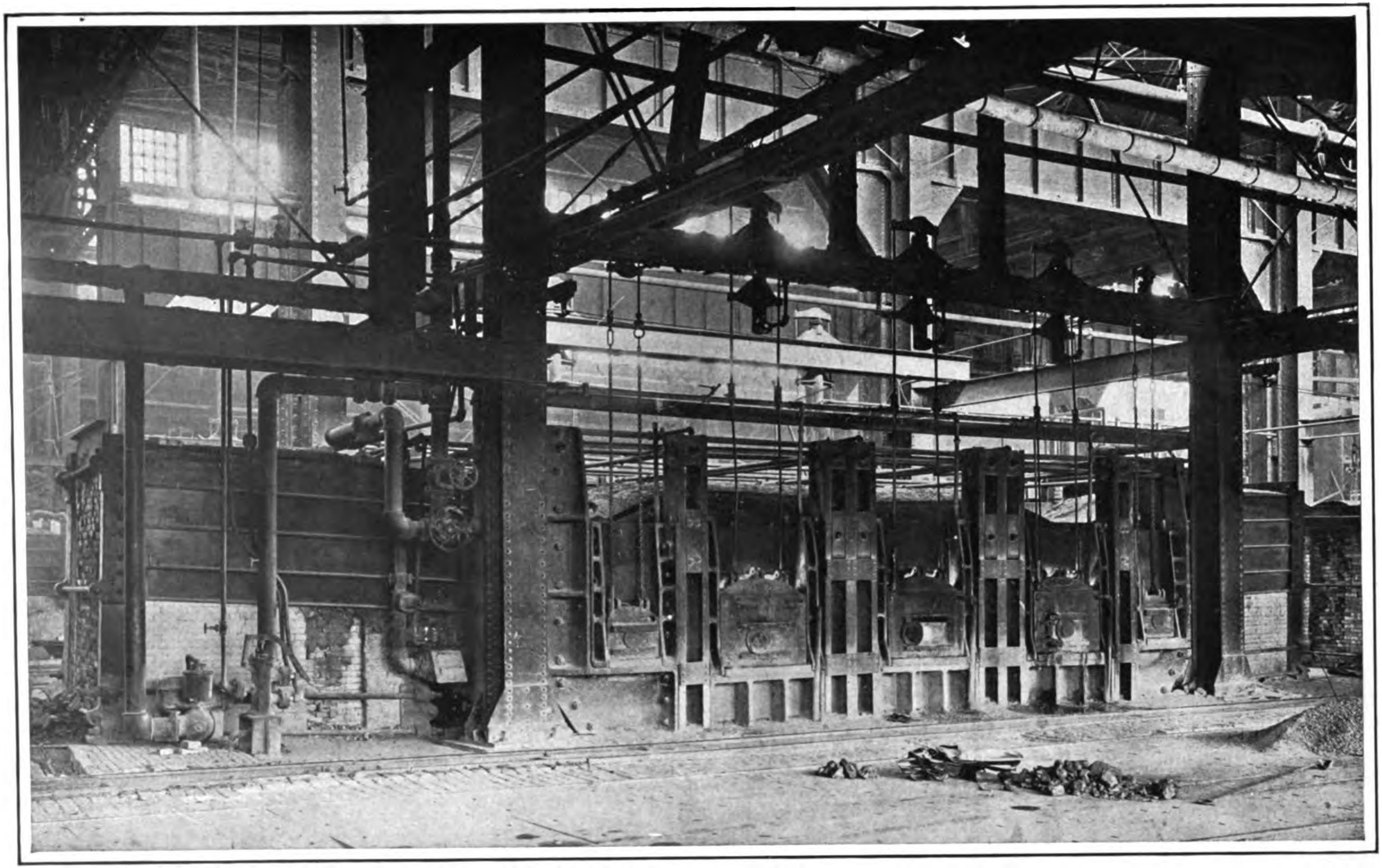


FIG. 2. CROSS-SECTION OF BESSEMER STEEL CONVERTER.

The chemical reactions which take place in the converter differ according to whether the converter is acid- or basic- lined. In both cases the object is to burn away the silicon and carbon of the pig iron, and then to add carbon in the proper proportions to make steel. The reason for this seemingly inconsistent practice of first burning away the carbon and then adding the same material is as follows: Pig iron contains varying quantities of carbon, and to burn away just enough would necessitate a different length of the blowing for each charge of iron, thus introducing complications difficult to handle. It was Bessemer's original plan to do this, however, and it delayed the general introduction of the process until the remedy was found by Mushet. This consisted in burning out the impurities and then adding a definite amount of carbon and manganese in the form of molten spiegeleisen or ferromanganese.

When air is blown through molten pig iron in a Bessemer converter, the first element affected is the silicon, and when the silicon is eliminated the carbon begins to burn and continues until there is only about 0.5 per cent. Up to the point where the carbon content has been reduced to 0.5 per cent., the reactions of the acid and of the basic processes are the same, but at this point the similarity ceases, for here the acid process ends, while the basic process begins its characteristic work of eliminating the phosphorus and sulphur. For practical purposes it may be assumed that neither the phosphorus nor sulphur contents of the original pig iron have altered at the time that the carbon content has reached 0.5 per cent. From that time on the phosphorus seizes the oxygen in the same way as the silicon and carbon had done before, the phosphoric acid immediately uniting with the lime which in the basic process is added to the metal at the beginning of the blow. The basic lining of the furnace is employed so that the lime may do its work without being affected by the lining material; were an acid lining used the silica would combine with the lime, thus rendering much of it incapable of doing useful work on the metal. The decarbonization, dephosphorization, etc., effected by the blowing process require to be supplemented by a further process before the final product of the converter is steel. This process is known as recarburization, and consists in adding carbon and manganese to the molten metal by the use of spiegeleisen or ferromanganese; the manganese promotes the removal of the sulphur with the slag. The amount of these materials to be added varies with the character of steel it is required to produce, and also with the process.

As has been stated, the process of steel-making which has just been described was the invention of Henry Bessemer, an Englishman. It developed from his efforts to produce a stronger metal than cast iron for the manufacture of ordnance. In 1854 James Nasmyth had patented a process for oxidizing the impurities of molten cast iron by introducing steam below the surface of the metal. Bessemer substituted air for steam, and patented the process in 1855. In his first experiments, Bessemer devoted his attention to the production of malleable iron, and such was his success that in 1856 he announced his work to the public. At this time, however, the process was far from perfect. Bessemer soon discovered that, while his process would remove silicon, manganese, and carbon from cast iron, it would not, when conducted in an acid-lined converter, remove phosphorus and sulphur. After some attempts to accomplish the removal of the last two elements, which met with poor success, Bessemer was compelled to revert to the use of iron so low in phosphorus and sulphur that it would make steel without any further diminution of these elements. Thus arose a classification of Bessemer pig, which still exists (see previous section on *Cast Iron*), and which means simply pig iron so low in phosphorus and sulphur that it may be made into steel without removal of these elements. The question of phosphorus being thus satisfactorily settled, Bessemer was confronted with the difficulty of so regulating the period of blowing that carbon should not be



OPEN-HEARTH FURNACE
Forty-Ton Open-Hearth Furnace at the Homestead Steel Works of the Carnegie Steel Company.

eliminated below the amount required in steel. As stated, this problem was solved by burning out practically all of the carbon and then adding a definite amount in the form of a recarburizer. In the same way, the necessary quantity of manganese was supplied. The success of the Bessemer process was not established commercially until 1860; from that date it has grown by leaps and bounds, until to-day it is perhaps the most important of the steel-making processes. Bessemer reaped fame and wealth from his invention, of which it has been truly remarked that it was of far more importance to the world than all the gold of California and Australia.

The open-hearth process of steel-making consists in making pig iron mixed with a greater or less quantity of wrought iron, steel, or similar iron products by exposure to the direct action of flame in a regenerative gas-furnace, and converting the resultant bath into fluid steel. Like the Bessemer process, the open-hearth process is divided into an acid process and a basic process; in the first the hearth is lined with sand and the slag is siliceous, and in the second the hearth is lined with a basic material and the slag is basic. Like the Bessemer process, also, the consideration of the open-hearth process may be divided into a discussion, first of the plant and mechanical operations, and then of the chemical reactions.

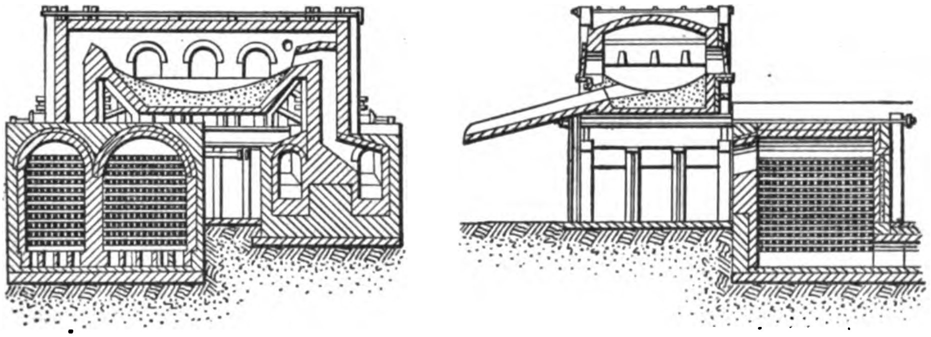


FIG. 3. TRANSVERSE AND LONGITUDINAL SECTIONS OF OPEN-HEARTH STEEL FURNACE.

The central figure of an open-hearth steel plant is the melting-furnace. This is always a regenerative furnace, for in no other construction is it practicable to obtain the necessary temperature, but its construction varies greatly in other respects. Fig. 3, showing a furnace designed for the Illinois Steel Company, of Chicago, may be used to explain the general features of construction and operation of an open-hearth steel furnace. In this drawing the checker-work shows the regenerating chambers, and the saucer-shaped structure above is the hearth. The two regenerating chambers are separate from each other, but either may be connected with the hearth and with the smokestack. Each chamber is nearly filled with a sort of cob-house work of brick. In operation, one chamber is heated so that the brick filling is white hot, and then a current of air and gas is admitted at the bottom. As this combustible mixture passes up through the heated brickwork, it is heated so that when it arrives at a point over the hearth it is burning fiercely. A portion of the heat of this combustion is given up to the charge on the hearth. From the hearth the hot gases pass down through the brickwork of the second chamber and serve to heat it, after which they escape at the bottom into the smokestack flue. As soon as the brickwork of the first chamber has become cooled below a certain point, the current of gases is reversed, so that they enter at the bottom of the second chamber and pass out of the bottom of the first chamber after being heated and ignited by the hot brickwork through which they have passed, and after passing over the hearth giving up their waste heat to the brickwork of the first chamber. By repetitions of this process of reversing the current of gases, the regenerative process is continuous, and a steady, intense heat is maintained on the hearth.

The hearth is usually a fixed structure, as shown by Fig. 3, but in some American works it is so constructed that it can be tilted like a Bessemer converter to receive its charge and to discharge its molten contents. This form of hearth is claimed to have several material advantages over the fixed hearth in case of operation and in producing steel from certain materials for certain special purposes. Whether fixed or tilting, the construction of the hearth consists of a steel and iron plate shell lined with some refractory material. In hearths for the acid process, the hearth-lining proper consists first of a layer of sand fused into a solid mass by heat. In hearths for the basic process the lining consists of a plastic compound made by roasting and grinding dolomite limestone and mixing the powder with tar. The accessories to the hearth consist of charging and tapping appliances, ladles and cranes for handling them, casting molds, etc.

In respect to their chemistry, the acid and the basic open-hearth process can best be considered separately. Referring first to the acid process, the proportions of the constituents of the charge vary in different places. Sometimes pig iron alone is used, but more generally pig iron and scrap wrought iron and steel are mixed. Whatever the mixture may be, it is necessary that its contents of phosphorus and sulphur be known, since these are not eliminated in the process. Broadly considered, the chemical reactions may be divided into three operations: first, the reactions during melting; second, the reactions after melting; and third, the reactions during recarburization. During melting the silicon and manganese are reduced by oxidization to a minute fraction of their original amounts and about one-half of the carbon eliminated. After melting, the remaining silicon, manganese, and carbon are eliminated by keeping the molten metal at a high heat and adding iron ore in successive small doses, thus forming silica and oxide of manganese, which go into the slag, and carbonic oxide, which escapes with the flame. To determine when this process has proceeded far enough, samples of the molten metal are taken at intervals, cast into iron bars and broken; the carbon content is estimated by the appearance of the fracture, an expert being thus able to determine its amount with much accuracy. When the desired point of carbon content has been reached, as determined by the test, the recarburizer is added in a solid state. This recarburizer is ferromanganese with a very large excess of manganese. In the basic process the problem is the melting and decarburization of the charge, as in the acid process just described, with the additional duty of removing a reasonable quantity of the phosphorus. This is accomplished by adding lime to the charge, which takes up the phosphorus and confines it in the slag. The basic lining in the furnace is necessary to leave the lime free to perform useful work, which would not be the case were an acid lining used which would take up a portion of the lime.

Recarburization is accomplished in much the same way as in the acid process. Summarized, the chemical problem of the open-hearth process is to eliminate from the crude iron of the charge all the silicon, manganese, carbon, phosphorus, and sulphur in excess of the amounts required for steel. The problem is practically the same in the Bessemer process, but the method of its solution is different. In the Bessemer process the metal is always blown until nearly all the carbon is eliminated, since it has been found impracticable to stop the operation at any intermediate point. All the carbon content of Bessemer steel has, therefore, to be supplied by the recarburizer, and absolutely perfect homogeneity of product can be secured only by absolutely perfect mixing of the molten metal and the recarburizer. This perfect mixing increases in difficulty as the amount of carbon required in the steel increases. In the open-hearth process the elimination of the carbon can be stopped at any desired point, so that very little carbon is added in the recarburizer, and the necessity of thorough mixing is less imperative. As a result it is generally considered that high carbon steel or hard steel can be produced with a more uniform quality by the open hearth than by the Bessemer process.

An important modification of the open hearth which has been described, and which is intermittent in operation, is the Talbot continuous open-hearth process, now in use in some American steelworks and being installed in several others here and abroad. Mr. Talbot's process consists essentially in working the furnace continuously by tapping off a portion of the molten charge at short intervals, immediately charging an equivalent of pig iron, and again tapping. Several advantages in increased output, economy of maintenance, wider range, etc., are claimed for the process.

The development of the open-hearth process of steel-making was the outgrowth of numerous attempts by inventors to repeat the success of Bessemer. Not much success was realized in these efforts, however, until 1862, when W. Siemens, a German, applied the regenerative furnace, which he had invented in 1857, to the manufacture of steel. It was not until 1868, when Siemens succeeded in making steel from old iron rails, that the success of the process was fully demonstrated. Meanwhile, P. and E. Martin, of Sireul, France, had succeeded in making steel from a mixture of pig iron and scrap in a Siemens furnace. Thus originated the Siemens-Martin process or open-hearth process of steel-making. At present, this process ranks second in importance only to the Bessemer process. The Bessemer process is practically without rival for the production of steel rails, but the open-hearth process leads in the production of structural steel, ship's plates, and steel for castings.

At first both the Bessemer and the open-hearth process were employed only with acid-lined furnaces, the basic process being a subsequent development. The practical invention of the basic process was due to Sidney G. Thomas and P. C. Gilchrist, and was first made public in 1878. The essential idea of the invention consisted in the substitution of a basic lining instead of the acid lining previously used in both the Bessemer and open-hearth processes, and the addition of a quantity of quicklime during the process so as to combine with the silicon and phosphorus, and thus to save the lining as much as possible. The success of the invention was not demonstrated until 1879, but since that time the process has developed rapidly. By this invention the enormous deposits of iron ores high in phosphorus, which had previously been excluded from use in the two great steel-making processes of the world, were rendered available to the steel-makers.

PHYSICAL PROPERTIES OF IRON AND STEEL. The physical properties of iron and steel which are chiefly useful to the engineer and manufacturer are strength, hardness, weldability, ductility, malleability, elasticity, and homogeneity. With the exception of weldability, all of these properties are exhibited to some extent by every piece of iron or steel. The relative degrees in which these different properties exist in different kinds of iron and steel vary greatly, however. This is a familiar fact to all, and does not need proof. The variation in these properties in different kinds of iron and steel is due partly to variation in the relative amounts of the contained chemical elements, partly to the physical structure, and partly to the method and amount of working to which the metal has been subjected to attain its final useful form. Commercially, iron and steel may be divided into the following general classes: Wrought iron, soft steel, medium steel, hard steel, cast steel, hard cast steel, cast iron, malleable cast iron. The chief physical properties of each of these classes of iron and steel will be referred to after a brief statement of the destructive effects produced by the different chemical elements upon the physical properties of iron and steel generally. The effects of carbon on iron and steel are more pronounced and useful than those of any other known chemical element; it constitutes about 4 per cent. of cast iron, and from ½ to 1½ per cent. of steel, and is nearly entirely absent from wrought iron. The effects of increasing the carbon element in iron or steel are to increase the hardness, strength, and fusibility, and to decrease the ductility, malleability, and weldability. The effect of increasing the silicon element of iron and steel is to increase the strength and soundness of steel and the fluidity of cast iron, and to reduce the ductility of steel. Manganese has the effect of counteracting the injurious effects of sulphur, phosphorus, and some other impurities, and increases hardness, fluidity, elasticity, and strength. Sulphur and phosphorus are nearly unmixed evils in iron and steel, and every effort is made to remove them from these metals.

The effect of none of these elements upon the metal is independent, but is influenced by the presence of one or more of the others. These interactions are too complicated to be discussed outside of special technical treatises. The effect of treatment during working upon the physical properties of iron and steel are numerous, and are referred to in the articles on ANNEALING; FORGE, FORGING; FOUNDING; ROLLING-MILL; WIRE.

Turning now to the physical properties of the several classes of iron and steel mentioned above, it may be noted, first, that strength may be subdivided into strength against rupture by direct pull, or tensile strength; strength against rupture by compression, or compressive strength; strength against rupture by bending, or flexural strength; and strength against shear, or shearing strength. (For the methods of measuring these various forms of strength, see STRENGTH OF MATERIALS.) Hardness is the capacity to resist indentation; weldability is the property which permits two or more separate fragments to be welded together; ductility is the property which renders the metal capable of being drawn out into rods or wire; malleability is the property which permits the metal to be hammered or pressed into different shapes; elasticity is the property which gives the metal power to return to its original form after distortion; and homogeneity is the property which secures uniformity of structure and mass.

Cast iron cannot be welded like wrought iron, and its malleability and ductility are practically nil; its tensile strength is from 15,000 pounds to 35,000 pounds per square inch; its compressive strength is from 60,000 pounds to 200,000 pounds per square inch; its flexural strength is from one-half to two-thirds its tensile strength; its elasticity is small. Wrought iron is malleable, can be forged and welded, and has a high capacity to withstand the action of shocks; it cannot be tempered, and melts only at the highest temperatures. Its tensile and compressive strengths are closely equal, and range from 50,000 pounds to 60,000 pounds per square inch; it is tough and ductile. The physical properties of steel depend upon the chemical composition and method of manufacture, and they vary so greatly, both relatively and absolutely, that no effort will be made to define them here. The mild and soft structural steels for bridges and buildings have tensile strengths of from 60,000 pounds to 70,000 pounds per square inch, with a limit of elasticity of from 30,000 pounds to 40,000 pounds per square inch. The hard steels have a much greater strength. The compressive strength of steel is always greater than the tensile strength.

USES OF IRON AND STEEL. The uses to which iron and steel are put are so familiar that only brief mention need be made of them. Cast iron is used chiefly in founding or iron-casting, the varieties and purposes of such castings being almost innumerable. Cast steel is used for many of the same purposes as cast iron, but more particularly for those purposes where castings of great strength are required. Wrought iron is forged into various shapes for special purposes, and is rolled into bars, plates, beams, rails, and structural shapes. Extra hard steels are used for tools, hard steel for piston-rods and other parts of machines, medium steel for rails and guns, and the mild and soft steels for beams and structural purposes.

STATISTICS OF PRODUCTION. The following table, rearranged from statistics published in *The Mineral Industry* (New York) for 1901, shows the production of iron and steel in the principal countries of the world for the twelve months of 1900:

COUNTRY	Pig iron, metric tons	Steel, metric tons
Austria-Hungary	1,350,000 (a)	675,000 (a)
Belgium	1,018,507	654,827
Canada	87,612	
France	2,699,424	1,624,048
Germany	8,351,742	6,645,869
Italy	20,000 (a)	58,000 (a)
Russia	2,850,000 (a)	1,500,000 (a)
Spain	294,118	150,684
Sweden	520,000	291,900
United Kingdom	9,052,107	4,800,000
United States	14,099,870	10,382,069
All other countries	625,000 (a)	400,000 (a)
Totals	40,968,960	27,182,347

Note—(a) Estimated.

As will be noted, the three great iron and steel producing countries of the world are Germany, the United Kingdom, and the United States.

Taking up the figures for the United States in somewhat more detail, we have the following, showing the relative output of the different classes of steel and iron:

PIG IRON		
CLASS	Long tons	Per cent.
Foundry and forge	4,517,437	32.8
Bessemer pig	7,943,452	57.6
Basic pig	1,072,376	7.8
Spiegeleisen and ferromanganese	255,977	1.8
Total	13,789,242	100

STEEL	
CLASS	Long tons
Bessemer	6,684,770
Open-hearth	3,402,552
Crucible and miscellaneous	131,250
Total	10,218,572

The principal pig-iron producing States of the United States in 1901 were: Alabama, 1,225,212 tons; Illinois, 1,596,850 tons; Ohio, 3,926,425 tons; and Pennsylvania, 7,343,257 tons.

BIBLIOGRAPHY. For a comprehensive discussion of the metallurgy of iron and steel, consult: Howe, *Metallurgy of Steel* (New York, 1890); Campbell, *The Manufacture and Properties of Structural Steel* (New York, 1896); and Turner, *The Metallurgy of Iron* (London, 1895). For details of the manufacture of iron and steel into special forms, see FOUNDING; FORGE, FORGING; ROLLING-MILL; WIRE.

IRON AND STEEL INSTITUTE, THE. An English association, organized by the iron trade of the north of England, the first meeting taking place in London, February 25, 1869. Its object is the discussion of practical and scientific questions connected with the manufacture of iron and steel. There are two general meetings each year, one in May, in London, and the autumn one in other cities, not always in Great Britain, for the institute has met in Paris, Vienna, Brussels, and New York. Since 1874 it has annually presented the Bessemer gold medal, for some invention or notable paper. The Institute publishes the semi-annual *Journal of Iron and Steel Industry,* containing original papers and abstracts from other publications.

IRONBARK TREE. A name given in Australia to certain species of Eucalyptus (q.v.), and particularly Eucalyptus siderophloia, on account of the extreme hardness of the bark. These trees attain a height of 80 or 100 feet, and a circumference near the base of 10 to 12 feet. The timber, which is very valuable for shipbuilding and other purposes in which hardness and durability are required, is rated as one of the strongest of Australian woods; its tensile strength exceeds that of hickory.

IRON CHANCELLOR, THE. A name given to Bismarck.

IRON CHEST, THE. A play by George Colman the Younger (1796), based upon Godwin's novel *Caleb Williams.*

IRON CITY, THE. Pittsburg, Pa., so called from its iron and steel industries.

IRONCLAD. See SHIP, ARMORED.

IRON CROSS (Ger. *Eisernes Kreuz*). A Prussian military order or decoration, revived during the war with France in 1871. It was first instituted by Frederick William III. as a reward for distinguished services in war. It consists of a Maltese cross, made of iron, edged with silver, and worn suspended from the neck or at the buttonhole. The superior decoration of the grand cross, a cross of double the size, is reserved for officers of high rank, who have successfully carried out a campaign, won a decisive battle, or conducted a brave defense of a fortress or position.

IRON CROWN. The name of the old crown of the Lombards, still preserved in the Church of Saint John the Baptist at Monza. It is made of six pieces, and is adorned with twenty-two jewels, twenty-six golden roses, and twenty-four enamels. On the inside there is a circlet of iron, said to be formed from a nail used at the Crucifixion, given by Pope Gregory I. to the Lombard Princess Theodelinda. Before the twelfth century it was called the golden crown. It was used at the coronation of the Lombard Kings, and of the German Emperors as Kings of Italy. In 1805 Napoleon crowned himself at Milan with it. Later it was worn by two Austrian Emperors, and carried to Venice. After 1866 it was restored to Monza. Consult Hodgkin, *Italy and Her Invaders,* vol. vi. (Oxford, 1880).

IRON DUKE, THE. A popular sobriquet for the Duke of Wellington.

IRON GATE (Turk. *Demir-Kāpu*). A celebrated pass on the Lower Danube, near Gladova, just below the point where the river leaves Hungary, where a spur of the Transylvanian Alps nearly barricades the river. In 1890 the demolition of the obstructions to navigation was begun by an Hungarian company, and in the course of ten years was practically completed. The work necessitated the excavation of nearly 1,200,000 cubic yards of rock, about half of which was in the river bed. For some distance there is an artificial waterway for vessels, through which there is an extremely rapid current.

IRON MASK, THE MAN IN THE (Fr. *L'homme au masque de fer*). The story of this mysterious prisoner confined at Pignerol, in the Bastille, and other French prisons in the reign of Louis XIV., has long excited a romantic curiosity in the minds of students of history. The first notice of him in print was given in *Mémoires secrets pour servir à l'histoire de Perse* (Amsterdam, 1745-46), in which the prisoner was identified with the Duke of Vermandois, a natural son of Louis XIV. and La Vallière, who had to expiate an offense against his half-brother, the Dauphin Louis, with imprisonment for life. This absurd assertion was without foundation; for the Duke of Vermandois died in 1683, whereas the prisoner is known to have died in 1703; but the confidence with which it was made caused a deep sensation, and the romance of Mouhy, *L'homme au masque de fer,* which immediately followed (Hague, 1746), was read with all the more avidity because it was prohibited by the Court. Voltaire, in his *Siècle de Louis XIV.,* treated the anecdote historically, but without doing anything to unravel the mystery. The first authentic information with regard to the Man in the Iron Mask, therefore, was given by the Jesuit Griffet, who acted for nine years as confessor in the Bastille, in his *Traité des différentes sortes de preuves qui servent à établir la vérité dans l'histoire* (Liège, 1769). He quoted from the manuscript journal of Dujonca, the royal lieutenant of the Bastille, according to which Saint Mars, the Governor of the island of Sainte Marguerite, in September, 1698, brought with him to the Bastille a prisoner whom he had already had in custody at Pignerol. The prisoner's face was always kept concealed by a mask of black velvet. The journal also mentions his death on November 19, 1703, and that he was buried in the cemetery of Saint Paul. This is confirmed by the register of burials for the parish of Saint Paul, where the prisoner is mentioned under the name of Marchiel, Marchiali, or Marchioli. These two entries are the bare facts of the case, and upon them have been erected theories and hypotheses without number. Besides the earliest story already mentioned, there have been at least four other explanations as to the identity of the prisoner. Among the minor conjectures are those which connect him with Fouquet, the financial minister of Louis XIV., and with the Duke of Monmouth, the illegitimate son of Charles II. of England, to mention only a few of many. An addition to the article on the subject in the *Dictionnaire philosophique* freely states the opinion that the prisoner was an elder brother of Louis XIV. The writer, who was probably the editor of the work, makes the prisoner an illegitimate son of Anne of Austria. Louis XIV. first learned the existence of his brother when he came of age, and put him in confinement to guard against any possible unpleasant consequences. Linguet, in the *Bastille dévoilée,* ascribes his paternity to the Duke of Buckingham. Saint-Michel, in 1790, attempts to connect the prisoner with a supposedly secret marriage between Queen Anne and Cardinal Mazarin. What is remarkable is that the Court continued to manifest an interest in the matter, and took every means to keep the identity of the prisoner in the dark. When the Bastille fell, the prisoner's room was eagerly searched and also the prison register; but all inquiry was vain. The Abbé Soulave, who published *Mémoires du maréchal Richelieu* (London and Paris, 1790), tried to establish from a document alleged to have been written by the tutor of that unfortunate prince that the Man in the Iron Mask was a twin brother of Louis XIV., and that, to avoid the calamities of a disputed succession to the throne, Louis XIII. had caused the later born of the twins to be brought up in secret. Louis XIV. learned of his brother's existence only after the death of Mazarin, and the twin brother, having discovered his relation to the King by means of a portrait, was subjected to perpetual imprisonment. This view of the matter was at one time almost universally prevalent. The first conjecture of what is still held by many to be the truth is contained in a letter dated 1770, written by a Baron d'Heiss to the *Journal Encyclopédique.* The same is repeated by Louis Dutens, who declares in his *Intercepted Correspondence* (1789) that there is no point of history better established than the fact that the prisoner in the iron mask was a minister of the Duke of Mantua. This minister, Count Matthioli, had pledged himself to Louis XIV. to urge his master, the Duke, to deliver up to the French the fortress of Casale, which gave access to the whole of Lombardy. Though largely bribed to maintain the French interests, he began to betray them; and Louis XIV., having obtained conclusive proofs of his treachery, contrived to have Matthioli lured to the French frontier, where he was secretly arrested April 23, 1679, and conveyed to the fortress of Pignerol, which was his first prison. The conclusions of d'Heiss and Dutens were followed up by Roux-Fazillac, who published a small work on the subject in 1801. This attempt to show that Matthioli was the Man in the Iron Mask, though clever, was not altogether successful; but the documents later discovered and published by M. Delort and M. Marius Topin seemed to leave little doubt on the subject, and the public had apparently made up its mind that the secret was at last discovered, until a still more recent work by a French officer, M. Jung, seemed to show conclusively that Matthioli could not have been the mysterious prisoner, and endeavored to prove that the Man in the Iron Mask was a soldier of fortune of Lorraine, Marechiel by name, who was the head of a widespread and formidable conspiracy, working in secret for the assassination of Louis XIV. and some of his ablest ministers. In the course of his researches, M. Jung examined some seventeen hundred volumes of dispatches and reports in the bureau of the Ministry of War. According to his story, Marechiel was arrested by order of Louvois in 1673, and after being brought to Paris was sent to Pignerol to be under the care of Saint Mars, who took him with him to Exilles (1689), Saint Marguerite, and finally to the Bastille (1695), where the prisoner died in 1703. The so-called iron mask, really a velvet one, was burned with his clothes and effects. Up to 1891 Jung's theory was considered satisfactory, but in that year Captain Bazières, of the garrison at Nantes, published a translation of some of Louis XIV.'s cipher dispatches to Louvois and the Minister's replies. From these it appeared that the mysterious prisoner was General de Bulonde, who was punished for his mistake or cowardice in raising the siege of Cuneo, by lifelong imprisonment at Pignerol, and later in the Bastille. During the last decade, however, there has been a reaction in favor of the Matthioli theory, due chiefly to the efforts of M. Funck-Brentano. Opinions still differ, and there is a tendency in many quarters toward regarding the Man in the Iron Mask as some obscure plotter, probably a valet possessed of a great secret, and therefore held in the strictest confinement. The whole question, however, is one of those mysteries of history that will probably never be satisfactorily solved, though it may be that the secret archives of the Vatican could throw light on the subject. The literature concerning the Man in the Iron Mask is very large. Up to 1870 fifty-two works had been written to elucidate the mystery, and since then over twenty more have appeared. The following list, therefore, is merely a selection of the best and most noteworthy contributions to the subject: Roux-Fazillac, *Recherches historiques sur l'homme au masque de fer* (Paris, 1801); Delort, *Histoire du masque de fer* (ib., 1825); Topin, *L'homme au masque de fer* (ib., 1870); Jung, *La vérité sur le masque de fer, 1664-1703* (ib., 1873); Loiseleur, *Trois énigmes historiques devant la critique moderne* (ib., 1882); Burgaud and Bazières, *Le masque de fer* (ib., 1883); Funck-Brentano, "L'homme au masque de velours noir dit le masque de fer," in *Revue Historique,* vol. lvi. (ib., 1894). The best work to consult in English is Hopkins, *The Man in the Iron Mask* (London, 1901).

IRONMASTER, The. A dramatization of Ohnet's *Maître des forges,* by Pinero (1884).

IRON MOUNTAIN. One of the isolated knobs of the Saint François Mountains, in Saint François County, Mo. It is 81 miles south of Saint Louis, on the Iron Mountain Railroad, and is 1097 feet in elevation above the sea and 200 feet above the adjoining valley. This mountain contains famous deposits of specular or hematite iron ore, one of the purest and richest ores found in the United States. The ore is magnetic, and in places has a thickness of 50 feet. It has yielded up to the present time over 5,000,000 tons of ore.

IRON MOUNTAIN. A city and the county-seat of Dickinson County, Mich., about 210 miles north of Milwaukee, Wis.; on the Chicago and Northwestern and the Chicago, Milwaukee and Saint Paul railroads (Map: Michigan, F 3). It is noted for large iron-mining interests. Settled in 1879, Iron Mountain was incorporated in 1888. The government is administered by a mayor, elected annually, and a unicameral council. Population, in 1890, 8599; in 1900, 9242.

IRON ORES. See Iron, section on *Iron Ores.*

IRON PYRITES. See Pyrites.

IRONS. The fetters used for confining prisoners. They consist of handcuffs, or *hand-irons*, and *leg-irons*, a pair of the latter being connected with light chains of sufficient length to permit the prisoner to walk, taking short steps. Irons are used to confine men for punishment, or for safekeeping when violent (as they frequently are when intoxicated), or when awaiting trial, and it is feared they may attempt to escape. The Spanish used to confine their prisoners in *bilboes*, which consisted of shackles around the ankles joined by a bar of iron. In the seventeenth and eighteenth centuries bilboes were used to some extent in the British Navy, and the name survived for a long time after the character of the irons had changed.

IRONSIDE, Nĕstor. A nom-de-plume used by Sir Richard Steele in the *Guardian.*

IRONSIDE, Sir. A knight of Arthur's Round Table.

IRONSIDES, Old. A name popularly used of the United States frigate *Constitution.* See Constitution, The.

IRONSMITH. A barbet. See Coppersmith.

IRONTON, ī'ẽrn-ton. A city and the county-seat of Lawrence County, Ohio, 140 miles southeast of Cincinnati; on the Ohio River, and on the Cincinnati, Hamilton and Dayton, the Detroit Southern, and the Norfolk and Western railroads (Map: Ohio, E 8). The Chesapeake and Ohio Railroad, on the opposite side of the river, maintains a free passenger ferry and a large freight transfer. Ironton is the centre of a region rich in iron ore, bituminous coal, and fire and pottery clay, and has extensive manufactories of iron (including foundries, machine-shops, blast-furnaces, rolling-mills, wire-drawing and nail works, etc.), cement, lumber, machinery, boilers, stoves, furniture, doors and mantels, and fire-brick. The city has a memorial hall, Masonic Temple, Odd Fellows' Hall, Briggs Public Library, and Kingsbury School. The parks are Beechwood, River View, and Lincoln. Settled in 1832, Ironton was incorporated in 1849. The government, under a charter of 1868, is vested in a mayor, elected biennially, and a unicameral council. The city owns and operates its waterworks. Population, 1890, 10,939; in 1900, 11,868.

IRONWOOD. A city in Gogebic County, Mich., 150 miles west of Marquette; on the Chicago and Northwestern and the Wisconsin Central railroads (Map: Michigan, C 2). Iron-mining is the principal industry, though lumbering is of considerable importance. Among the more prominent buildings are a fine city hall, the Luther L. Wright High School, and the Carnegie Public Library. Settled in 1884 and incorporated in 1887, Ironwood is governed under the revised charter of 1893, which provides for a unicameral council, and for a mayor, elected annually, and controlling, subject to the consent of the council, the appointments of all subordinate officials excepting the school trustees. Population, in 1890, 7745; in 1900, 9705.

IRONWOOD. A name given to the hard, heavy timber of various trees. Metrosideros vera, a native of Java and other Eastern islands, is much valued by the Chinese and Japanese for making rubbers, etc., and is exported in small quantities. The bark is used in Japan as a remedy for diarrhœa and mucous discharges. Mesus ferrea, a native of the East Indies, is planted near Buddhist temples for the sake of its fragrance and rose-like flowers, with which the images of Buddha are decorated. In Australia the name ironwood is given the timber of Melaleuca genistifolia, Myrtus gonoclada, Notelæa ligustrina, and Olea paniculata. In the United States it is applied to Ostraya Virginica and Carpinus Americana (see Hornbeam), and other trees which have tough wood. Olea laurifolia and Sideroxylon inerme, called ironwood in the south of Africa, are valuable timber-trees.

IRONY (Lat. *ironia*, from Gk. *ειρωνεια*, *eirōneia*, dissimulation, irony, from *ειρων*, *eirōn*, dissembler, from *ειρειν*, *eirein*, to talk). The name given to that peculiar style of thought and expression by which words are made to convey a meaning exactly opposed to their literal sense. When skillfully used, irony is one of the most crushing and irresistible figures of rhetoric. It was such an instrument in the hands of Swift, who gravely proposed to the people of Ireland that they should rid themselves of poverty by eating their children. Irony united with a kindlier feeling is one of the charms of Thackeray's style. There is also the irony of fate, or of events, where the issue is otherwise than might be expected. Representative of this highest form are the great tragedies of Sophocles and Shakespeare; for example, *Macbeth*, where the equivocations of the witches lead the hero step by step to his ruin.

IROQUOIAN (ĭr'ô-kwoi'ȧn) **STOCK.** One of the most important linguistic stocks of the American Indians, formerly inhabiting a large part of the present Ontario, New York, Ohio, and Pennsylvania, with portions of eastern Virginia and North Carolina and the whole of the southern Allegheny region. The stock name is derived from that of the Iroquois (q.v.), or confederated Five Nations of New York—the Mohawk, Oneida, Onondaga, Cayuga, and Seneca. Other important tribes were the Wyandot (or Huron), Neutral Nation, Erie, Conestoga, Nottoway, Meherrin, Tuscarora, and Cherokee.

Both tradition and history indicate the lower Saint Lawrence region as the early home of the Iroquoian tribes, whence they gradually worked their way up the river, the Hurons, Neuters, and others finally establishing themselves in the peninsula of Ontario; the Iroquois proper, with the Erie, Conestoga, Nottoway, and Tuscarora, turning southward, while the Cherokee, who appear to have constituted the advance guard of the migration, wandered so far from the body of their kindred that for a long time the relationship was considered doubtful. The primary cause of the removal of the Iroquoian tribes from the Saint Lawrence country appears to have been the hostility of the neighboring Algonquian tribes. In 1535 Cartier found an Iroquoian people holding the sites of the present Quebec and Montreal; but seventy years later the same territory was in possession of Algonquian tribes. The formation of the Iroquois League checked the Algonquian invasion and enabled the Iroquois to assume the offensive. Linguistic and other evidence shows that the separation of the Cherokee from the parent stock must have far antedated this period.

All the tribes of this stock were agricultural, being noted above their neighbors for their fields of corn, pumpkins, and tobacco, to which, at a later period, were added orchards of apple and peach trees. Those of the North occupied communal 'long houses' of poles overlaid with bark, in wagon-top shape, and sometimes from 80 to 100 feet in length. Among the Cherokee and others of the South each family occupied a house of a single room, usually built of logs plastered over with clay. The 'town house' of the Southern tribes, reserved for ceremonial purposes, was a large round structure of logs, with a conical earth-covered roof. The clan system had reached a high development among all the Iroquoian tribes, and women occupied a position of much importance, while the inherent tenacity of character and capacity for organization exhibited by the Indians of this stock gave them a controlling influence wherever they were established, and enabled them more than any other of the Eastern tribes to withstand the new civilization. The present population of the Iroquoian tribes is about 40,000, of whom about 10,000 are in Canada. The Cherokee constitute fully one-half of the whole body.

IROQUOIS, ĭr'ō-kwoi'. A confederacy of five tribes of Iroquoian stock—Mohawk, Oneida, Onondaga, Cayuga, and Seneca—to which the Tuscarora were afterwards added. They called themselves by names signifying respectively 'we of the long house' and 'real people.' The term *Iroquois* is of French origin, being possibly compounded from two ceremonial words of frequent occurrence in their councils, with the addition of the French suffix *ois*. Another theory makes it an Algonquian derivative. Their Algonquian neighbors knew them as *Mengwe* or *Nadowa*, about equivalent to 'alien' or 'enemy,' while by the English they were designated as the Five, or Six, Nations.

The people found by Cartier in 1535 occupying the shores of the Saint Lawrence River from the present Quebec to Montreal were of Iroquoian stock, as proved by linguistic evidence, and appear to have been, in part at least, the ancestors of the later Iroquois. These tribes were dispossessed shortly afterwards by the more powerful Algonquian tribes, some, like the Hurons, taking refuge farther to the west, while others, including the Iroquois, retired to the south. Shortly after this withdrawal—probably about the middle of the sixteenth century—the tribes known later as the Five Nations were persuaded by the counsel of their traditional legislator, Hiawatha, to form a league or confederacy upon such a well-ordered plan that it has endured for more than three centuries, and exists to-day as their ruling government, in spite of all the changes brought about by the advent of the white man. The five tribes at this time occupied central and western New York, where they were found in 1609 by Champlain, who, by joining forces with their Algonquian enemies, brought down upon the French the lasting vengeance of the Iroquois League, which was one of the main factors in the ultimate loss of Canada.

By the formation of the league, in which each tribe represented a State government, with a central federal council of fifty chiefs sitting at Onondaga, the Iroquois were enabled to withstand the inroads of the hostile Algonquian tribes, and even to assume the offensive. On the establishment of the French missions among the Hurons (see WYANDOT), about the year 1630, the Iroquois, who in the meantime had been supplied with firearms by the Dutch on the Hudson, began war upon their kinsmen in Canada with such effect that in a few years those of the Hurons who had not been slaughtered or carried into captivity were forced to abandon their country and fly hundreds of miles to the west. The same fate soon after befell the cognate Neutral Nation and the Erie, as well as the Ottawa and others of Algonquian race, resulting in almost complete ruin to the French missions in Canada. The destroyers then turned upon the Conestoga and others in the South, the Mohican and others east of the Hudson, and the Miami and Illinois in the West, until by the year 1700 they claimed and were conceded a paramount influence and dictation from Hudson Bay to the Cherokee frontier of Carolina, and from the Connecticut almost or quite to the Mississippi, the only tribes able to make successful opposition being the Ojibwa in the Northwest and the Cherokee in the South. From the beginning of the colonial period they held the balance of power between France and England in the North, and were courted alike by both, but remained steadfast to the English interest. The few exceptions were chiefly in the case of the Mohawk and Cayuga, who yielded to the influence of the French Jesuit missionaries, by whom they were finally drawn off from the territory of the league and settled in the mission villages of Caughnawaga and Saint Regis. About the year 1715 the cognate Tuscarora, who had been driven out from North Carolina in a war with the settlers, removed to New York, where they were assigned lands by the Iroquois and admitted as the sixth nation of the league.

At the outbreak of the Revolution in 1775 the league council declared for neutrality, while allowing each of the six component tribes to take sides as it thought fit. The great majority of the Iroquois sided against the Americans, only the Oneida and a part of the Tuscarora refusing. The Mohawk and Cayuga followed their great chief, Brant, in a body to Canada. At the close of the struggle these, with other Iroquois who had supported the English cause, were settled by the Canadian Government on a reservation on Grand River, Ontario, where most of them still remain, others being at Quinté Bay, Thames River, and Gibson, in the same province. The Catholic Iroquois are at Caughnawaga, Saint Regis, and Lake of Two Mountains, in Quebec Province, but are no longer affiliated with the league. Those of Caughnawaga constitute the largest single Indian settlement north of Mexico. In addition to the Catholic Saint Regis Iroquois in Canada, about as many more are on the New York side of the line, the reservation having been cut in two when the boundary was finally established by survey. The Iroquois in the United States are all on reservations in New York, excepting the Oneida, most of whom removed to Wisconsin about 1820, and a mixed band of so-called 'Seneca' in the Indian Territory. In general it may be said that they are fairly prosperous, those of Caughnawaga heading the list.

The political importance of the Iroquois, although due in part to their geographic situation and early acquirement of firearms, was in great measure the result of their superior system of organization and of their individual force of character. The same traits have enabled them to hold their own in the midst of an alien surrounding. Prominent features of their system were the council of matrons, the elaborate clan structure, and the wholesale adoption of captives, who, if spared, were admitted to full tribal rights, instead of being reduced to semi-slavery, as among some other tribes. The best single source of information upon the confederacy is probably Morgan, *League of the Hodenosaunee or Iroquois* (Rochester, 1854). Dialectically all the Iroquoian tribes closely resemble each other.

The present number of the Iroquois, including those of the Catholic mission colonies which have cast off all allegiance to the ancient league, is considerably above 17,000, distributed as follows: Ontario, Canada, 'Iroquois and Algonquins of Gibson,' 125 (perhaps one-half being Iroquois); 'Mohawks of the Bay of Quinté,' 1230; 'Oneidas of the Thames,' 810; 'Six Nations on the Grand River,' 3930. Quebec, Canada, 'Iroquois of Caughnawaga,' 1960; 'Iroquois of Saint Regis,' 1325; 'Iroquois and Algonquins of Lake of Two Mountains,' 440 (perhaps one-half being Iroquois). In the United States—New York reservations, 5340; Wisconsin (Oneida), 2030; Indian Territory (Seneca), 340.

IROQUOIS, or MATILDA. A port of entry and manufacturing town of Dundas County, Ontario, Can., 43 miles southeast of Ottawa, on the left bank of the Saint Lawrence (Map: Ontario, H 3). It has a station on the Grand Trunk Railway, and commands the entrance to the Iroquois Canal. Population, in 1891, 1047; in 1901, 1097.

IRRATIONAL NUMBER. Any number that cannot be expressed as the quotient of two integers. A fraction or quotient of two integers may be expressed in the form of either a terminating or a non-terminating decimal, the latter always containing a repetend. (See DECIMAL SYSTEM.) Thus, $\frac{8}{5}$ equals 1.6, a terminating decimal; $\frac{2}{3}$ equals 0.6666....., a non-terminating decimal. In either case the decimal may be transformed again into the common fractional form by the formulas of series (q.v.). But when the process of evolution is applied to integers and the results are expressed decimally, there is often produced a decimal form that is non-terminating, contains no repetend, and cannot be expressed as the quotient of two integers. For example, the 'surd' $\sqrt{2}$ equals a number (1.4142..) containing a non-terminating and non-repeating decimal, and cannot be expressed as the quotient of two integers. While, however, evolution thus often results in an irrational number, it is not every irrational number that can be expressed in the form of a surd. This may be plainly seen in the case of π, the ratio of the circumference to the diameter of a circle. The value of this irrational number to five decimal places is 3.14159..... See CIRCLE.

Certain operations with irrational numbers were performed by the ancients. The Pythagoreans proved the irrationality of the square roots of 3, 5, 7, .. 17. The arithmetic part of Euclid's *Elements* contains a geometric treatment of the subject. Archimedes approximated the value of a great number of surds, stating, for example, that $1351 / 780 > \sqrt{3} > 265 / 153$, but the method by which he arrived at his results is unknown. In the Middle Ages Fibonacci, and still later Stifel and Rudolff, devoted much attention to irrationals. But not until very recent times has a purely arithmetic theory of surds been produced, through the researches of Weierstrass, Dedekind, Cantor, and Heine, whose efforts were inspired by a desire to fortify the basis of analytic mathematics. No adequate explanation of these methods can be given here. That of Weierstrass starts with a consideration of the formation of different kinds of number through arithmetical operations. Dedekind arranges positive and negative, integral and fractional numbers in order of magnitude, and observes that any rational number, as a, divides the system into two classes, C_1 and C_2, so that every number in C_1 is less than every number in C_2, and a is either the greatest number in C_1 or the least in C_2. These rational numbers are then represented by points on a straight line. But there are still an infinite number of points on the line for which there are no corresponding rational numbers. He then shows that to every one of these points corresponds a unique irrational number. Cantor and Heine introduce irrational number through the concept of a fundamental series. Following is an example of the series method. The surd $\sqrt{2}$ lying between 1.4142 and 1.4143 may be expressed thus:

$$\frac{14}{10}+\frac{1}{100}+\frac{4}{1000}+\frac{2}{10000}<\sqrt{2}<\frac{14}{10}+\frac{1}{100}+\frac{4}{1000}+\frac{3}{10000}$$

or more generally

$$\frac{N_1}{10}+\frac{N_2}{10^2}+\frac{N_3}{10^3}+\cdots\frac{N_p}{10^p}<\sqrt{2}<\frac{N_1}{10}+\frac{N_2}{10^2}+\frac{N_3}{10^3}+\cdots\frac{N_p+1}{10^p}$$

Now, as p becomes indefinitely great, $\sqrt{2}$ evidently becomes the common limit of the two series, and may therefore be defined by them. Expressing the sum of the series on the left by P/Q, and that on the right by $(P+1)/Q$, the square root of 2 may be expressed by the relation $P / Q < \sqrt{2} < (P+1) / Q$. Similarly, any irrational number I may be expressed by the relation $P / Q < I < (P+1) / Q$, where P and Q are derived from the corresponding series.

Consult: Dedekind, *Essays on Number*, trans. by Beman (Chicago, 1901); Dirichlet, *Vorlesungen über Zahlentheorie* (Brunswick, 1879); Stolz, *Vorlesungen über allgemeine Arithmetik* (2 vols., Leipzig, 1885-86).

IRRAWADDY, ĭr'ȧ-wä'dĭ, or **IRAWADI.** The principal river of Burma. It rises on the extreme northeast border, near Mount Daphabum, a peak of the Nam-kiu Mountains, and flows southward with a tortuous course over 1500 miles, till it enters the Bay of Bengal through a large delta between the cities of Rangoon and Bassein (Map: Burma, B 3). The scenery along its banks is extremely varied; the lower valley, especially the delta, is occupied by wide and level rice-fields; farther up there are undulating, fertile, and thickly populated agricultural districts, broken here and there by large forests, and in three places the river breaks through mountain ranges in narrow and rocky defiles. The third or uppermost of these, which is 140 miles above Bhamo and 1168 miles from the sea, is the head of navigation for boats and small steamers. Below this the river is wide and deep, and the current not too swift, even for sailboats. Steamers ply regularly to Bhamo, and the river is an important artery of commerce for the interior of Burma, though it has now been supplemented by a railroad running parallel with its valley from Rangoon to Bhamo, crossing the river at Mandalay. For 100 miles from the sea extensive embankments have been built to protect the low delta-plain from inundations. For a recent description of the river and the country on its banks, consult Mowbray, "A Sail Down on the Irrawaddy," in the *Scottish Geographical Magazine,* vol. xvii. (Edinburgh, 1901).

IRREDENTISM (from *irredentist,* It. *irredentista,* from *Italia irredenta* (unredeemed Italy), *irredenta* being from Lat. *in-*, not + *redemptus,* p.p. of *redimere,* to redeem, from *red-*, back again + *emere,* to buy, take). A popular movement which originated in Italy after 1878, having for its object the recovery of what its adherents call 'unredeemed Italy,' *Italia Irredenta,* meaning all that territory at present belonging to Austria, Switzerland, France, and England having an Italian-speaking population, but no longer forming part of Italy. Under this description would come Southern Tyrol, Trieste, Görz, Istria, and Dalmatia, the Swiss Canton of Ticino, Corsica, Nice, and Malta. To all but the most exalted patriots the chimerical nature of the Irredentist programme is apparent, inasmuch as its execution would involve the surrender by Switzerland of territory it has held for more than three hundred years, by Austria of its only seaport, Trieste, and by England of its great base in the Central Mediterranean, Malta. Irredentism has ceased to be an influential factor save with the younger element in Italian politics. It received a severe setback in the formation of the Triple Alliance embracing Austria, the special foe against whom the Irredentist movement was aimed. See POLITICAL PARTIES, paragraph on *Italy.*

IRREDUCIBLE CASE. See CUBIC EQUATION.

IRREFRAGABLE DOCTOR. See ALEXANDER OF HALES.

IRREGULARS (ML. *irregularis,* not according to rule, from Lat. *in-*, not + *regularis,* relating to rule, from *regula,* rule, from *regere,* to rule). A military term generally applied to partisan troops assisting the regular establishment. They are, as a rule, only partially trained and equipped, as, for instance, the Franc-tireurs (q.v.) in 1871; some of the Cossack (q.v.) regiments of Russia; the Bashi-Bazouks (q.v.) of Turkey; and the armies of the feudatory chiefs and rulers of India. See ARMIES.

IRRIGATION (Lat. *irrigatio,* from *irrigare,* to irrigate, from *in,* in + *rigare,* to moisten; connected with Goth. *rign,* AS. *regn,* OHG. *regan,* Ger. *Regen,* Eng. *rain,* and probably with Gk. *βρέχειν, brechein,* to wet). In agriculture, the method of increasing the productiveness of soils by an artificial supply of water. The practice of irrigation is very ancient. There is evidence to show that works for the storage and distribution of irrigation water were constructed in Egypt as early as B.C. 2000. Extensive works, intended for irrigation on a large scale, existed in times of remote antiquity also in Assyria, Mesopotamia, Persia, India, Ceylon, China, and other parts of the earth, as well as in Peru and Mexico in the Western Hemisphere. Remains of ancient irrigation works are found in the Southwestern United States (New Mexico and Arizona). In all of these regions irrigation is necessary for successful agriculture, because the rainfall is insufficient for the needs of ordinary crops. Irrigation is also required even in humid regions for crops, such as rice and cranberries, which require a large amount of water.

The area of the earth's surface over which the rainfall is deficient (less than 20 inches or 500 millimeters), and irrigation consequently a necessity for successful agriculture, is very extensive. In addition to this vast area in which, as a rule, agriculture is impossible without irrigation, there are considerable areas in the so-called humid regions in which the irregularity of the rainfall makes irrigation profitable. The extent to which the arid lands can be reclaimed depends upon the water-supply available for irrigation. It has been estimated that there is sufficient water to irrigate only about one-fifth of the arid region of the United States, or from 150,000,000 to 200,000,000 acres. Of this irrigable area probably less than 10,000,000 acres have already been reclaimed. In Europe irrigation prevails chiefly in the south, where it was introduced by the Romans. It is most extensively and systematically practiced in Lombardy, Spain, and the south of France, but exists to some extent in other parts of Europe. Wilson estimates the irrigated area in Italy to be about 3,070,000 acres, in Spain 500,000 acres, in France 400,000 acres. Nowhere is irrigation practiced on so large a scale as in India, and the irrigation systems of that country are being rapidly extended by the British Government. According to Wilson, the irrigated area in India is about 25,000,000 acres. Egypt follows with 6,000,000 acres, although irrigation works now in process of construction will vastly increase this area. Only at a comparatively recent date has irrigation been introduced into Australia, but it is rapidly extending there. The same is true in a measure of South Africa. The practice of irrigation has declined, or entirely disappeared, in many of those regions where it prevailed most extensively in remote antiquity.

WATER-SUPPLY FOR IRRIGATION. Water for irrigation is derived from (1) natural streams, springs and lakes; (2) wells; and (3) storage of storm waters. Occasionally also the sewage water of towns is used for irrigating purposes. The simplest and most common method of securing water for irrigation is to divert it from streams by means of a dam and a ditch or canal running along the sides of the valley of the stream, at a less grade than that of the stream itself. When the fall of the valley is great the canal can be readily led off to such a distance that extensive areas may thus be supplied with water. When the fall of the stream is slight, however, the canal may wind along close to the stream for miles before any extensive areas lie beneath the canal in a position to receive the water it carries.

It frequently happens that a diverting dam or one or more large storage reservoirs must be provided. In a number of instances submerged dams have been built across the valley of a stream whose waters disappear in summer. The practice is to build reservoirs and headworks generally at the highest suitable point consistent with good location for both these structures and the upper portions of the conduits leading from them.

Reservoirs are often increased by adding to the heights of the dam as the demand for water increases. The financial resources of most American irrigation works are likely to be limited at the start, would-be irrigators following rather than preceding the development of water-supply. On this account early works are often temporary in character. Again, both labor and material are apt to be so dear as to render cement masonry construction quite out of the question. Consequently many timber or timber and loose stone dams, have been built, and more ambitious structures of the rock fill type (see DAMS AND RESERVOIRS) have been erected. In some cases even flimsy brush dams, loaded with stone and earth, have been thrown across or partly across a stream, with the full knowledge that they would not last more than a year or two at best.

Artesian wells are a most important source of supply for irrigation in many western sections of the United States. In Kansas, Nebraska, and other States very fair supplies may be obtained from comparatively shallow wells by pumping. In California water is sometimes developed by tunneling into hillsides. Where pumps have been used they have generally been simple in construction and of small capacity. Large numbers of windmills are employed to drive small pumps on the Great Plains, mostly for domestic water-supply, but not infrequently for irrigation. Many of these are home-made, resembling the simplest form of paddle water-wheel, or are more elaborate, according to the mechanical ability or ambition of their makers. Serviceable and durable windmills (q.v.) are now so cheap and so much more efficient than the home-made affairs that there is little excuse for not having one wherever it can be put to good use. Small storage reservoirs are a necessary adjunct of windmills, since there may be no wind when water is most needed, and since they also make it possible to save the night pumping. Such reservoirs may be constructed by intelligent farmers at comparatively little cost by throwing up earth embankments. In some cases a concrete or asphalt lining may be required to prevent leakage, but oftentimes the earth may be so packed, or puddled, by wetting and ramming it, as to make more expensive lining unnecessary. Where available, motor power is a cheap means of lifting water. Its applications to that end range all the way from a series of buckets mounted on a wheel placed in and driven by the stream to the most modern and efficient combination of pumps driven by turbines. Hydraulic rams are also employed.

In a comparatively few instances steam pumping engines are used, particularly where large quantities of water are to be lifted to a considerable height. This is true in California, Hawaii, and elsewhere, where large areas of land are irrigated by immense pumping plants. Gasoline engines are used to drive pumps. They require but little more attendance than a windmill, and have the great advantage of not being dependent upon the uncertainties of the wind. In America the quantity of irrigating water raised by pumps of all kinds is small, but in Europe, Africa, and Asia much pumping is done. In Egypt and in some Asiatic countries, however, most of the pumping is very primitive, the power being applied by men or animals. Pumping is increasing of late with the development of water from wells and with the demand for water to irrigate land that cannot be reached from existing low-level canals. In many instances water can be secured in this way at less expense than by gravity, since it permits the utilization of near-by sources, thus avoiding long and costly canals. The water, too, is more directly under the control of the irrigator.

Assuming that a good supply of water for irrigation is available either by diversion from streams, by storage of storm waters, by pumping from wells, or from any other source, the question to be here discussed is the best means of utilizing it for the production of crops.

METHODS OF APPLYING IRRIGATION WATER. Main canals and conduits are often the most expensive part of irrigation works, owing to their length and the difficulties encountered in their construction. The cheapest and simplest conduit is a ditch, heading in the source of supply, and departing just sufficiently from the natural contour of the country to insure a flow of water. In the early days of irrigation such ditches were little more than single furrows, or channels no larger than might be formed by a plow, leading a short distance from the banks of a stream. To-day there are thousands of miles of irrigation ditches, or canals, large enough for small boats, while in India it is quite common to build combined irrigation and navigation canals, thus affording a ready outlet for the products of the irrigated area and inlets for supplies. In rolling or hilly country canals may have to follow circuitous routes to maintain their level, thus adding greatly to their length. It may be cheaper, or, when a stream or valley is encountered, even necessary, to continue the line of the canal, changing the construction to an elevated flume, or else substituting a pipe or inverted siphon, laid on or in the

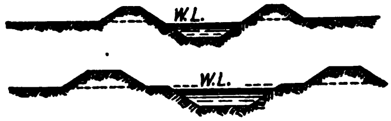


FIG. 1. EARTH CANAL UNLINED.

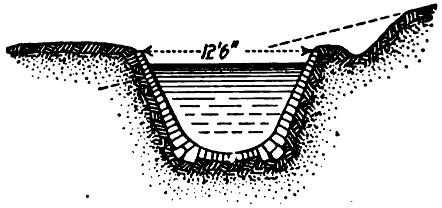


FIG. 2. CANAL IN EARTH LINED WITH MASONRY.

ground. Where grades and other conditions permit canals should be made narrow and deep rather than wide and shallow, in order to lessen the surface exposed to evaporation.

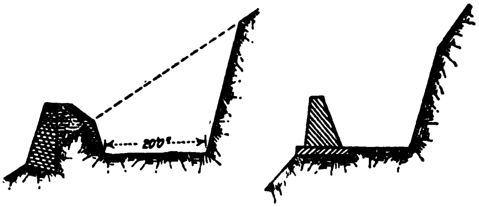


FIG. 3. CANALS ON ROCK SLOPE WITH RETAINING WALLS.

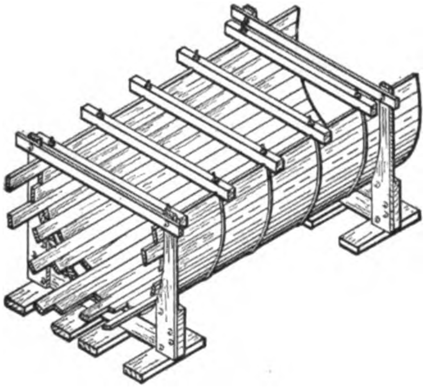


FIG. 4. SEMI-CYLINDRICAL WOOD-STAVE FLUME.

Seepage should be guarded against. To this end lining with stone laid in mortar or with concrete or with cement mortar may be employed. A great advantage in linings, if reasonably smooth, is that they increase the carrying capacity of the canals by lessening the friction, and aid in maintaining it by lessening the sedimentary deposits and plant growths on their sides and bottoms. Sometimes leakage may be diminished by throwing powdered clay into the water at the head of the canal. The sedimentary matter naturally carried by the water will often reduce the leakage in a few months or years.

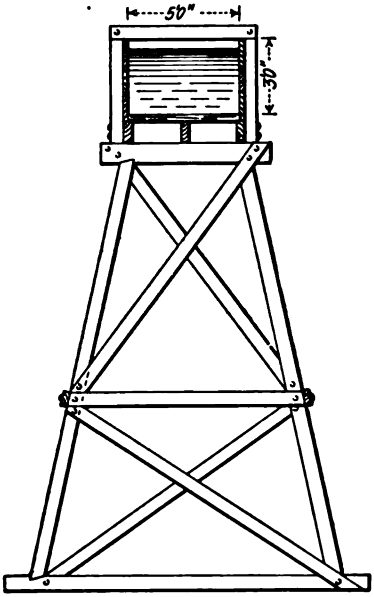


FIG. 5. WOOD IRRIGATION FLUME ON TRESTLE.

Flumes are most commonly built of wood, with a rectangular cross-section, but in recent years steel has been employed, particularly in precipitous rocky locations, or where crossing streams or deep ravines. The ordinary flumes of boards or plank are subject to leakage. To avoid this, and also to give a channel better adapted to the flow of water, wooden staves are now being employed, formed into a semi-circular or other shape designed to give a curved bottom. The staves are held in place by steel rods or bands, so arranged that they can be tightened by turning nuts. The steel flumes are made of thin plates riveted together. Flumes may rest on mudsills, or timbers placed on the ground,

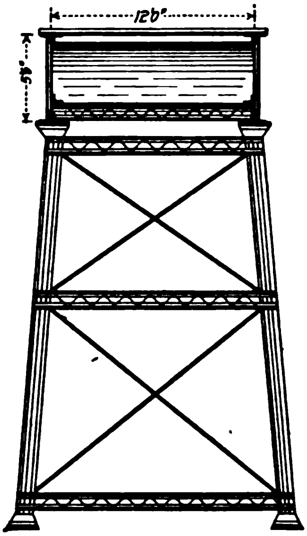


FIG. 6. STEEL IRRIGATION FLUME ON TRESTLE.

but, being generally designed to cross depressions, they are more frequently supported on trestles. The trestles, like the flumes, are generally of wood, but they are sometimes of steel, particularly where the flume proper is of that material, or where the flume support must be in spans, as at a stream crossing.

When, instead of valleys or streams, hills are encountered, necessitating a long detour for canals, tunnels are often employed. They do not differ materially from other tunnels. If lining is necessary, as in earth, or to reduce the friction when in rock, it may be of brick, concrete, or stone, and resembles that for masonry aqueducts in tunnels. See TUNNELS; AQUEDUCTS.

Headworks of some kind are required for nearly all canals, flumes, or pipe-lines. In America they are generally of timber, but in much of the foreign work they are permanent structures of stone. The essential features are a bulkhead, gates, and wasteway. Where there is a dam at the head of the canal, the headworks may be at one end of it, or form a part of it.

Pipes may be substituted for canals or flumes, either to convey water across depressions or under streams, as already mentioned, or to prevent losses from both evaporation and seepage. Either riveted steel or wood staves are the materials most commonly used for such pipes, being preferable to cast iron on account of their relative lightness, and consequent ease of transportation in rough country, remote from railways. Where the water is under little or no pressure either vitrified clay or cement pipes are sometimes used, particularly in southern California.

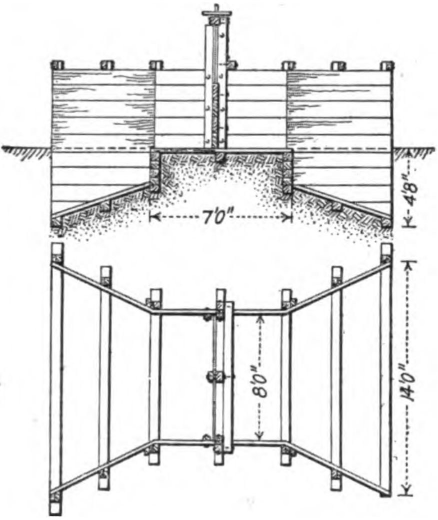


FIG. 7. HEAD-GATE FOR SMALL IRRIGATION CANAL.

Works for Final Distribution consist chiefly of open or closed channels, generally the former, leading from the main or branch canal or other conduit to the land to be irrigated. For the most part small ditches are employed, with permanent or movable gates, or temporary earth dams, to divert the water to or from the minor channels. Except as modified by the topography, the application of water to land is chiefly a detail of agriculture rather than engineering, depending on the crop and the soil and also the ideas of the cultivator. Subsurface irrigation is generally considered impracticable because of the difficulties experienced in securing a thorough spreading of the water, besides which the pipes may clog and the construction prove expensive. Surface application, therefore, is almost universally employed. Broadly speaking, the latter is effected either by flooding the whole surface or sending the water through furrows. Neither involves much engineering skill, but it is best to have the main channels located with the aid of a level, particularly where the areas are large or have an irregular surface. Where pipe systems are employed for final distribution thin wrought iron or steel, or vitrified pipe, may be used, and hydrants must be provided for drawing out the water.

The distribution of water by means of underground pipes, standpipes, and hose is, however, too expensive for irrigation on a large scale. The open ditch, which takes the water out of the larger canal or reservoir to the land to be irrigated, is made to follow the contour of the land, so that the flow is moderate and uniform and the water can be readily distributed to lateral ditches or flumes at any desired point. The simplest method of turning water from a ditch is to cut a hole in the side and to use earth to make a dam in the ditch. An improvement on this method is the use of portable cloth, wood, or metal dams or 'tappoons.' The water is spread over the land by a variety of methods, which belong, as a rule, in three main classes: (1) Flooding, (2) furrow irrigation, and (3) sub-irrigation.

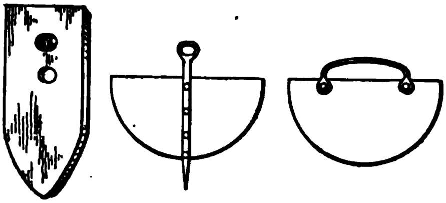


FIG. 8. TAPPOONS (WOOD AND METAL) FOR USE IN IRRIGATION.

Wickson describes the following methods practiced in the Western United States: (1) Free flooding, or running water on the land without restraint, except that of the banks of the lateral conveying it. In this method the ditches or laterals are carried along the higher parts of the field and the water is released by spade cuts at intervals in the banks, or it is made to overflow the banks by means of dams, as described above. This is the oldest and simplest method of irrigation. It is best suited to small grains and forage plants which are sown broadcast, and is most effective with nearly level ditches and on land of uniform grade. On account of the labor involved and the difficulty of securing uniform irrigation, this method has been superseded in many places by one of the check systems. (2) Flooding in contour checks or irregular areas of land inclosed by low embankments, the size and shape of these areas being determined by the inequalities of the surface. This method is best adapted to land of very gentle slope. Its first

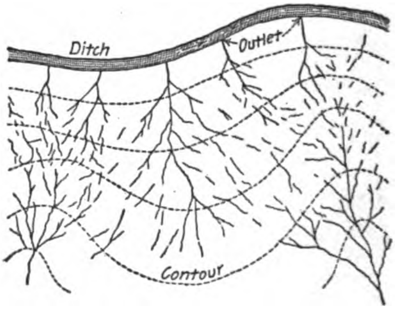


FIG. 9. IRRIGATION BY FLOODING.

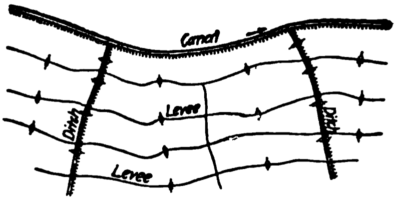


FIG. 10. CHECKWORK IRRIGATION.

cost is considerable, but it permits more effective irrigation with less labor than free flooding. In this method the highest check is filled from the ditch or lateral, and the water is either allowed to overflow into the next lower check, or is drawn off into it by means of gates provided for the purpose. (3) Flooding in rectangular checks, or level areas of approximately the same size inclosed by low embankments. This method is little used except for orchard, vineyard, garden, and rice irrigation, being largely superseded for other purposes by the contour check method. Unless the land is quite level, its preparation for the method involves the shifting of a large amount of earth, and the levees of irregular heights which are required interfere with the use of power machinery in cultivating. (4) Depressed bed method, in which the ditches are carried on the tops of the levees and the water is allowed to soak out into the checks inclosed by the levees. This is a garden modification of the rectangular check system, and is used in the growing of vegetables and small fruits. It is best suited to porous soils, which require frequent irrigation. A primitive form of this method is ridge irrigation, in which plants are grown on the sides or at the base of raised ditches. (5) Furrow irrigation, or running water in furrows between the rows of crops, is the simplest, cheapest, and most widely used method of irrigating crops which can be grown to advantage in rows, and is adapted to a wide range of slope and soil conditions. If the slope is not too great to carry a small stream without excessive washing, the rows are run straight down the grade from the supply ditch or flume, which occupies the crest of the highest ground; otherwise the rows are run diagonally at the angle giving the proper grade. The length of furrow that can be used depends upon the character of the soil and the head of the water. The more porous the soil, the larger should be the stream or the shorter the furrow. For most field and garden crops a larger stream and a shorter run are used than for fruit-trees. Laterals or supply ditches are usually taken across the slopes of the land at intervals of about forty rods. The laterals should be as nearly level as possible, so that they can be kept full and will discharge uniform amounts of water through the openings into the furrows. (6) Raised-bed irrigation, in which a raised bed is surrounded by a small ditch from which the water passes into the soil by seepage and capillary action, is a modification of the furrow system, especially suited to rather heavy, retentive soils in which water moves readily. (7) Subirrigation, or distribution by means of underground pipes with suitable outlets, or from tile drains or blind ditches, from which the water can rise to the roots of plants by capillarity. The method is expensive and of doubtful practicability, except on a limited scale, in greenhouse and other horticultural work. A similar method, known as 'underflow irrigation,' consists in opening furrows at considerable distances apart and keeping them filled with water until the ground water rises so that it can reach the roots of plants by capillarity. The method is little used. (8) Distribution by means of underground pipes, standpipes, and connections for sprinkling is a method which is considered too expensive for use on a large scale.

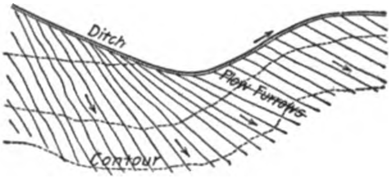


FIG. 11. FURROW IRRIGATION.

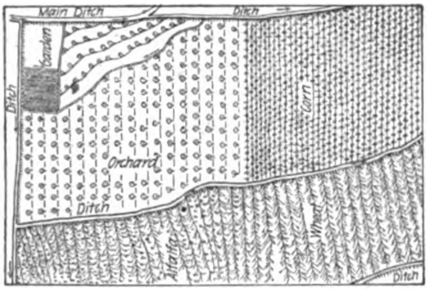


FIG. 12. PLAN OF IRRIGATED FARM.

The choice of a method must be determined by the amount of water available, the slope and nature of the land, the character of the crop, etc.

According to Wickson, a method to be of value must secure the following results: "(1) Distribution of moisture evenly throughout the soil mass to as great a depth as possible, providing it does not sink beyond the reach of the plant by root extension nor beyond recovery by capillary rise; (2) economy of labor both in aggregate time and in the feasibility of operating without employment of extra hands; (3) economy of water in the prevention of waste by overflow or evaporation or by rapid percolation, and in placing the water where it will do the most good; (4) leaving the land in the best condition for attaining with least labor a state of tilth which conserves moisture and at the same time favors thrift in the plant." Crops sown broadcast can be irrigated only by flooding or sprinkling. Flooding is also best adapted to very loose soils. The contour check and furrow method require least labor. The furrow method is best suited to subsequent cultivation by horse-power, which is a matter of great importance, since thorough cultivation, to overcome the compacting tendency of irrigation and to secure a soil mulch, should in all cases follow as soon after irrigation as the condition of the soil will permit. Deep and thorough preparation of the soil increases its storage capacity for water, and frequent cultivation of the surface reduces loss from evaporation, thus reducing materially the amount of irrigation required and enabling the soil to utilize to the best advantage whatever rainfall may occur.

DUTY OF WATER IN IRRIGATION. The amount of water required to irrigate different crops under varying conditions is a matter of fundamental importance, but has never been very accurately determined, and there is no very accurate simple means of judging when a soil needs irrigation. The term *duty of water* is commonly used to express the number of acres which a given quantity of water will adequately irrigate and is best stated in *acre-feet* or *acre-inches*, which are the amounts of water required to cover an acre 1 foot or 1 inch deep, respectively (43,560 and 3630 cubic feet, respectively). The water is usually measured to consumers in *cubic feet per second*, or *second-feet*. A second-foot is a flow of 1 cubic foot of water in a second of time. One second-foot will supply an acre-inch in 1 hour and 30 seconds, one acre-foot in 12 hours and 6 minutes. "In 24 hours, a stream of 1 second-foot would supply 23.8 acre-inches, and would cover 7.93 acres of land with water 3 inches deep." (King.) A common unit of measurement of water in the Western United States is the *miner's inch*, which is the amount of water which will flow through a hole 1 inch square in 1 second of time under a certain pressure or head (which, theoretically, is 6 inches, but which varies in different States). In California 50 miner's inches are considered equal to 1 second-foot; in Colorado, 38.4.

The duty of water, reported on the basis of area actually irrigated with a given amount of water, varies so widely in different localities and conditions of water-supply that it is of little or no value as a measure of the water actually required in crop production, however useful it may be as a rough guide in estimating the required capacity of irrigation works. A more accurate measure is the actual amount of water required to produce the maximum yield of a crop under given soil and climatic conditions, and this, as already intimated, has not received the investigation its importance demands. King gives the following as the minimum amounts of water required to bring the crops named to maturity under conditions of absolutely no drainage and the smallest possible evaporation, assuming also that at the time of planting the soil already possesses a sufficient amount of moisture:

HIGHEST PROBABLE DUTY OF WATER FOR DIFFERENT YIELDS OF CERTAIN CROPS

NAME OF CROP		Bushels per acre										
		15	20	30	40	50	60	70	80	100	200	300
Wheat	Least number of acre-inches of water required.	4.5	6	9	12	15	18					
Barley		3.21	4.28	6.42	8.56	10.7	12.84	14.98				
Oats		2.35	3.13	5.70	6.27	7.84	9.40	10.98	12.54	15.68		
Maize		2.52	3.36	5.04	6.72	8.4	10.08	11.75	13.43	16.77		
Potatoes			.41	.62	.83	1.03	1.24	1.45	1.65	2.07	4.14	6.2

NAME OF CROP		Tons per acre											
		1	2	3	4	6	8	10	12	14	16	18	20
Clover hay (15% water)	Least number of acre-ins. of water requir'd.	4.43	8.85	13.28	17.7	26.55	35.4	44.25					
Corn, with ears (15% water)		2.08	4.16	6.24	8.32	12.47	16.61	20.72	24.95	29.1	33.26	37.42	41.58
Corn silage (70 % water)		1.41	2.82	4.23	5.64	8.46	11.28	14.1	16.92	19.74	22.56	25.38	28.2

While the above figures give much greater duties than are secured in actual practice, and cannot therefore be taken as absolute guides, they will be helpful in estimating the possible duty of water. The duty of water in many cases is determined very largely by the water-supply. If water is scarce the duty will be high, if abundant the duty is likely to be low.

All general statements as to the duty of water must be received with caution, owing to the variation of duty with the local conditions already mentioned as governing the quantity of water required in irrigation. Wilson's *Manual of Irrigation Engineering* gives a table for various countries of the world, expressed in acres per second-foot. To put those figures on a more definite basis, a column headed "Inches per ten days" has been added in King's *Irrigation and Drainage*. The modified table is reprinted herewith. It should be noted that it is based on measurements at the head of the canals, and therefore includes losses by seepage and evaporation, as it properly should. The higher duties in southern California are due largely to the care taken to prevent these losses and to apply the water to the crops with a minimum of waste. Such care is more feasible in that section than elsewhere, on account of the intense cultivation there employed and the high values of the products obtained. Some more recent American figures of duties, expressed in acre-feet, are given in *The Use of Water in Irrigation*, Bulletin No. 86 of the United States Department of Agriculture, Office of Experiment Stations, being reports on investigations made under the direction of Elwood Mead. These records showed a range of from 2.10 acre-feet for the period from June 16 to September 16, 1899, at Bozeman, Mont., to 6.30 acre-feet from April to September, 1899, at Salt Lake City. The rainfall in each case was less than a half inch during the period named. Special measurements at other localities showed a range of from less than 1 to more than 15 acre-feet, but the conditions were abnormal. Where the duty was measured at the point of use, instead of at the head of main canals, it was found that more than as much water was lost in the canals as was available for application on the fields.

AMOUNT OF WATER USED IN IRRIGATION IN DIFFERENT COUNTRIES

(Adapted from Wilson, by King)

NAME OF COUNTRY	No. of acres per sec. ft.	No. of inches per 10 days
Northern India	60 to 150	3.967 to 1.587
Italy	65 to 70	3.661 to 3.4
Colorado	80 to 120	2.975 to 1.983
Utah	60 to 120	3.967 to 1.983
Montana	80 to 100	2.975 to 2.38
Wyoming	70 to 90	3.4 to 2.644
Idaho	60 to 80	3.967 to 2.975
New Mexico	60 to 80	3.967 to 2.975
Southern Arizona	100 to 150	2.38 to 1.587
San Joaquin Valley	100 to 150	2.38 to 1.587
Southern California	150 to 300	1.587 to .793

The fact should not be lost sight of that there has been in the past and still exists a general tendency to excessive irrigation. This gives not only low duties, but results in over-saturation of the soil and has rendered large areas of the lower-lying lands in irrigated regions unfit for cultivation by flooding them with seepage water or by causing the rise of alkali. (See ALKALI SOILS.) For these reasons thorough drainage, either natural or artificial, is a necessary accompaniment of irrigation, as a protection against the harmful results of excessive irrigation.

AMOUNT AND FREQUENCY OF IRRIGATION. The conditions that must be taken into consideration in determining the amount of water to be applied are: (1) The storage capacity of the soil, (2) the depth to which the roots of the particular crop penetrate, (3) the rate at which water will rise from the soil below the root zone, and (4) the dryness of the soil and the subsoil. The frequency of irrigation will be determined by: (1) The amount of available moisture which the soil can store, (2) the rate at which moisture is lost by transpiration through the plant and by evaporation from the soil, and (3) the degree of dryness of the soil which the plant will tolerate without injury. Where the soil is deep and mellow the roots of plants extend to a great depth and over a wide area. Thus having a wider field from which to draw supplies of moisture and plant food, the actual percentage of moisture in the soil may be smaller without detriment to the plant than if the root-feeding was more restricted. Again, compact, clayey soils hold moisture so tenaciously that plants growing on them begin to suffer for moisture, even when the soil contains a percentage of water which in case of less tenacious, sandy soil would be abundant for the plant's needs. The aim in irrigating should be to apply simply enough water to meet the needs of the plant without loss in the drainage. It is well to bear in mind in attempting to accomplish this desired result that plants vary in their water requirements at different stages of growth. Edmond Gain reports investigations which indicate that at the time of planting the soil should have about 25 per cent. of the total amount of water which it is capable of holding, then it should fall to 15 per cent. and remain at this point until the first leaves are formed, when it should be raised quickly to nearly 40 per cent. It should be allowed to fall rapidly to about 25 per cent. and remain at this point until shortly before flowering, when it may be raised gradually to 40 per cent. and then allowed to fall rapidly to 12 or 15 per cent., where it remains during fruiting and maturity. King has found that a crop of maize yielding 70 bushels per acre can be brought to maturity in 110 days with 11.75 acre-inches of water, applied in 3 irrigations at intervals of 37 days on soil of medium texture, or in 5 irrigations at intervals of 22 days on the most open soil. With higher yields the number of irrigations has to be correspondingly increased. A crop of wheat yielding 40 bushels per acre requires 12 acre-inches of water, applied in 3 or 5 irrigations according as the texture of the soil is medium or very coarse. Barley yielding 60 bushels per acre may be brought to maturity in 88 days with 12.84 acre-inches of water applied in 3 or 5 irrigations, at intervals of 29 and 18 days, on medium and coarse soils respectively. Actual practice varies widely in different parts of the world. Three to five irrigations seems to be about the average for wheat. With maize it varies from 3 in Italy to 15 in Egypt, but 5 to 7 irrigations appears to be about the average. It is usual to give only one irrigation for each crop of clovers and alfalfa. Water meadows are irrigated as often as the water-supply will permit. The practice with potatoes is to give 2 to 4 irrigations, according to the slope and texture of the soil, beginning when the plants have nearly or quite reached the blossoming stage. In actual practice the intervals between irrigations of fruit-trees and vineyards vary from 7 to 40 days. According to Wickson, fruits in California receive 2 inches of water per month during May to August, on retentive soils, and 3 inches during the same period on coarse soils. In rice culture the land is kept flooded the greater portion of the time during the growth of the crop. According to Maxwell, it is a common practice in Hawaii to apply 200 to 250 acre-inches of water to sugar during a growing period of 18 to 20 months, although experiments have shown that 100 acre-inches is ample.

DIVISION AND MEASUREMENT OF WATER. Successful irrigation is very largely dependent upon the judgment of the irrigator, and this in case of an expert is probably as reliable as measurements, in our present knowledge of the duty of water. Measurements, however, are necessary when many irrigators draw their water-supply from the same source. In this case various methods of division and measurements are used.

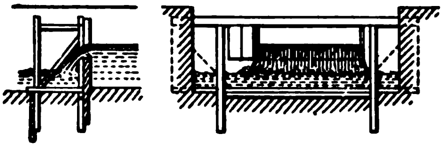


FIG. 13. MEASURING WEIR.

When the supply is small and the whole of it can be used by each irrigator to advantage, water is often distributed on the time basis, allowing each user to have the whole stream a length of time proportionate to the amount of water to which he is entitled. By this method there is a rotation in the use of water. When the supply is too large to be used by a single individual, various devices, called *divisors*, are used to apportion to each user the proportion of water to which he is entitled, or *modules*, *measuring weirs*, and *spill-boxes* are employed to measure each irrigator a definite quantity of water. This division and measurement of water for irrigation is controlled by law (see following page). The right or privilege of using water from a canal, ditch, or stream in definite quantity or upon a prescribed area of land, is termed a *water right*, and such

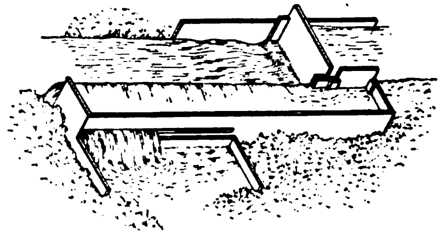


FIG. 14. FOOTE'S MEASURING WEIR AND SPILL-BOX.

right or privilege is usually acquired either by priority of use or by purchase. In an arid region, where so much depends upon the supply of water, a water right is a very valuable property. See Hydrography; Water-Supply.

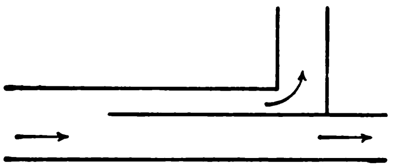


Fig. 15. DIVISION BOX.

Quality of Irrigation Water. The character of the water available for irrigation purposes is a matter of great importance. All natural waters carry more or less organic and mineral matter in suspension or solution, and thus furnish, in addition to the water so necessary for the growth of plants, a certain amount of fertilizing matter. Waters carrying a large amount of soluble matter should, however, be used with caution, since they may cause the accumulation of alkali in the soil in injurious amounts. Of the waters available for irrigation, sewage is most valuable on account of the fertilizing matter carried to the land. Sewage irrigation is practiced with success in Great Britain and on the Continent of Europe, notably on the Craigenlinny meadows, near Edinburgh; at Gennevilliers, near Paris; in the vicinity of Berlin; at Milan, Italy; and also at a number of places in the United States.

Laws and Institutions. The development of irrigation in the Western United States has given rise to many complex legal, economic, and social problems. This has resulted from lack of uniform laws regarding ownership, control, and distribution of the water-supply and uncertainty as to State and Federal jurisdiction. These complications become acute, for example, when, under State laws, all the water of a stream is absorbed for irrigation purposes, and the Federal courts assert the paramount importance of riparian rights and the protection of navigation, regardless of the use of the water in irrigation. Again serious complications arise when a stream crosses the boundaries of two or more States and each claims all the water flowing on its soil, as well as when the sum of the individual claims largely exceeds the amount of water available.

There is a strong popular demand in the West for public aid in the construction of irrigation works too large for private capital and enterprise to undertake, especially for the building of reservoirs for the storage of water, as is done, for example, by England in Egypt and India, where the largest irrigation works in the world are being built by the British Government. Another matter of vital importance in connection with irrigation is the protection of the forest growth of the watersheds of the streams, with a view to mitigating floods and securing a more uniform flow of the streams. The importance of this matter is beginning to be realized, and steps are being taken to protect the forests of these watersheds from the wanton destruction to which they have been subjected in the past. The practice of irrigation has given rise to many interesting economic and social conditions. Among other things it has been productive of small proprietors and diversified and intensive farming; it furnishes admirable training in self-government and encourages coöperation; and has removed the evils of isolation in farm life by making possible the building of homes in village centres, thus realizing a happy combination of town and country life.

Irrigation in Humid Climates. Supplemental irrigation to carry crops through periods of drought has been found profitable in many cases in humid regions, especially on light, well-drained soils and with crops of high value. To what extent the practice may be extended with advantage has not been definitely determined. The rainfall of such regions is a disturbing factor. If a heavy rain occurs soon after a thorough irrigation, more serious damage may be done by excess of water than would have resulted from drought, especially if the soil be compact and poorly drained. Irrigation should therefore be attempted in such regions only on soils provided with thorough natural or artificial drainage.

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1884); Wilcox, *Irrigation Farming* (New York, 1893); King, *Irrigation and Drainage* (New York, 1899); Smythe, *Conquest of Arid America* (New York, 1900); Kinney, *Treatise on the Law of Irrigation* (Washington, 1894); Long, *Irrigation Law* (Saint Paul, 1901). Among the periodicals devoted to irrigation are *Irrigation Age* (Chicago) and *National Irrigation* (San Francisco). Bibliographies of irrigation will be found in the annual report of the Colorado Experiment Station for 1891 (Fort Collins, Col.), and in the *Eleventh Annual Report* of the United States Geological Survey, 1889-90, part ii., and a bibliography is in course of preparation under the direction of the librarian of the United States Department of Agriculture.

See articles on AQUEDUCT; CANAL; DAMS AND RESERVOIRS; FLUME; HYDROGRAPHY; PUMPS AND PUMPING MACHINERY; SEWAGE DISPOSAL; TUNNEL; WATER-METER; WATER-SUPPLY.

IRRITABILITY (Lat. *irritabilitas*, from *irritabilis*, irritable, from *irritare*, to irritate). The state or condition of the protoplasm of plants when it responds to a change in external influences or the adjacent protoplasm. The change which initiates the response is called a stimulus. When the nature of the stimulus is unknown, automatism is predicated rather than irritability. Temporarily the protoplasm may lose the power of responding to a stimulus, but when this is permanently lost the protoplasm is dead. Temporary loss of irritability may be occasioned by prolonged or repeated stimulation, in which case the loss is said to be due to fatigue; or by unfavorable conditions, such as deficient moisture, low or high temperature, lack of oxygen, etc.

The agents affecting plants are extremely numerous and varied. The light changes both in intensity and direction from hour to hour; the temperature fluctuates, the moisture in air and soil is seldom the same for two consecutive days. The nature of the stimulus does not in any way determine the character of the response, but this is conditioned by the mechanism which the stimulus sets in action. As there is unlikeness between stimulus and reaction, so there is disproportion between them in the energy involved. Although the stimulus stands to the reaction apparently in the relation of cause to effect, it only initiates a series of changes, in the course of which the energy stored in living protoplasm is set free, and this produces, through the appropriate mechanism, the result observed. The stimulus is only a releasing cause, and, were the energy not provided by the living protoplasm, no reaction would occur. The only apparent exception to this is seen when a stimulus inhibits the action of an organ whose normal function requires the expenditure of energy. Here the release of energy seems to be prevented. In the absence of exact knowledge as to how this is accomplished, it may be assumed that it is by counteraction rather than by suppression.

The limitation of irritability by unfavorable external conditions, the phenomena of fatigue, and the disproportion between the stimulus and the reaction it calls forth lead to the formation of an hypothesis regarding the state of the protoplasm when it is irritable. Briefly stated, this hypothesis assumes that a substance which is readily decomposed is produced by the protoplasm or developed as part of it. When a stimulus acts upon the protoplasm this substance is decomposed, and in its destruction energy is liberated, by means of which the response is made. In those cases of activity which occur without the action of any known stimulus, it may be assumed either that an undiscovered stimulus is acting to initiate the necessary decomposition, or that the protoplasm may decompose itself 'at will' and release energy. The energy thus released may be applied to contraction; that is, to changing the form of the protoplasmic body, to secretion, to increasing or retarding the rate of growth, etc.

Not all portions of the plants are equally sensitive to a given stimulus. Indeed, in many cases the sensitive regions are sharply localized and very limited. It has been shown, for example, that sensitiveness of a root to the stimulus of gravity is limited to the terminal millimeter or two. In other parts the whole growing region may be sensitive. When the sensitive region is sharply localized, it may be coincident with the region in which the response is perceived, or it may be separated from it by a considerable distance. In the latter case a propagation of the stimulus must occur. There are in plants no definite structures corresponding to the nerves of animals, though in roots fibril-like structures in the protoplasm have recently been claimed to be the lines along which the propagation of the stimulus from the perceptive to the active region occurs. Setting in action the mechanism of perception, the propagation of the stimulus, and the execution of the final response consume time. In some plants the final response follows in a fraction of a second after the stimulus is received, as in the sensitive plant. In most cases, however, the end reaction is separated in time from the initiation of stimulation by seconds, minutes, or even hours. This interval is known as the reaction time. When it is sufficiently long, a stimulus may be applied during a portion of the reaction time and then discontinued. After the usual interval, however, the reaction will still occur, although no stimulus is then operating. Such effects, the results of previously acting stimuli, are known as 'after-effects.' The time during which any stimulus must act in order to call forth a response is the presentation time.

The reaction to a stimulus may consist either in a change in the amount of rate of a function, or in a change in the character of a function. In the former case the stimulus may either accelerate or retard. The latter form of reaction is much less common than the former. Further, the reaction may be either direct or induced. Induced reactions are such as will not occur in response to the stimulus acting unless some other stimulus first brings about a change; after which reaction to the first stimulus becomes possible. Thus a plant may not respond to stimulation by gravity unless it is first stimulated by light. It is difficult, therefore, to disentangle the effects of different stimuli without extreme care in experimentation. Every living cell of the plant is in reality an irritable structure. Since movement is the most easily observed reaction, the mistake has been made of considering motor organs as being specially irritable regions. Thus, tendrils, the leaves of the sensitive plant, the peculiar motile leaves of the Venus's fly-trap, the tentacles of the leaves of Drosera, the contractile filaments of many anthers, etc., are looked upon as sensitive organs *par excellence*. In reality, however, many of these are far inferior in sensitiveness to structures whose reactions are less evident.

IRRITANCY (from *irritant*, from Lat. *irritare*, to render void, from *irritus*, *inritus*, invalid, from *in-*, not + *ratus*, decided, p.p. of *reri*, to think). In Scotch law, the forfeiture of an estate as the result of a breach of condition, express or implied, or the happening of an event upon which the termination of the estate is made to depend. The irritant or fatal condition, or proviso, may be an incident of the estate granted, as the duty annexed to a feudal freehold, or it may be the result of an expressed provision, known as an irritant clause, contained in the deed creating the estate affected by it. See CONDITION; FORFEITURE.

IRRITANT (from Lat. *irritare*, to irritate, annoy). An agent that causes increased circulation, pain, increased function, or muscular contraction, when applied to an animal tissue. Among the irritants are many vegetable and the mineral acids, strong alkalies, bichloride of mercury, nitrate of silver, mustard, croton oil, turpentine, etc. The term has been sometimes vaguely applied to medicines which produce irritation of nerves in distant parts when taken internally, as instanced in the action of strychnine upon the spinal cord. Heat is a mechanical or kinetic irritant. Light is also an irritant to the retina, and in diseases of the eye is often a powerful one. Electricity is an irritant when applied in certain forms. See COUNTER-IRRITANT.

IRTYSH, ĭr'tĭsh. An affluent of the Obi, and fourth in importance among the rivers of Siberia (Map: Asia G 3). It rises in the southwest range of the Altai Mountains in China, whence it flows in a northwest direction through Lake Zaisan-Nor, past the city of Tobolsk, until it reaches the Obi, after a course of 2633 miles. Its chief affluents are the Bukhtarma, the Om, and the Tara from the right; and the Ishim, the Tobol, and the Konda from the left. The basin of the Irtysh, comprising the governments of Tomsk, Tobolsk, Perm, and Orenburg, the territories of Akmolinsk, Turgay, and Semipalatinsk, and some Chinese territory, covers the immense area of 638,000 square miles. The Irtysh is ice-free about 200 days in the year, and is navigable for nearly 2000 miles. The principal ports are Semipalatinsk, Pavlodar, Omsk, Tara, and Tobolsk.

IRÚN, ē-rōōn'. A frontier town of Spain, in the Province of Guipúzcoa, situated on the Bidassoa River, here forming the French boundary, five miles from its mouth in the Bay of Biscay (Map: Spain, E 1). It is a military station and a first-class port of entry. It contains an interesting old church, restored in 1508, and has manufactures of leather, tiles, and bricks. Population, in 1900, 9669.

I'RUS. (1) A beggar of Ithaca, an attendant of Penelope's suitors. (2) The hero of Chapman's comedy *The Blind Beggar of Alexandria*.

IRVINE, ẽr'vĭn. A seaport in Ayrshire, Scotland, on the Irvine, a mile above its mouth, in the Firth of Clyde (Map: Scotland, D 4). Shipbuilding, iron-founding, and the manufacture of chemicals, book-muslins, jaconets, and checks are the chief branches of industry. Duntonknoll Quarry yields a stone largely used for the making of bakers' ovens. Neighboring coal-mines yield the principal article of export. The principal features of the town are the municipal building, a fine bridge, and the academy, an educational institution of high repute. The town owns its water-works. Mentioned as early as 1184, Irvine is described as a chartered burgh in the reign of Robert Bruce. Its chief relics of antiquity are the square tower of Stanecastle and the Norman Seagatecastle. Population, in 1901, 9603.

IRVINE, WILLIAM (1741-1804). An American soldier. He was born in Ireland, graduated at Dublin University, and was surgeon on an English war-ship during the Seven Years' War, at the close of which (1763) he emigrated to America, and settled at Carlisle, Pa. In 1774 he was a member of the Provincial Convention, and in January, 1776, was appointed colonel of the Sixth Pennsylvania Regiment. At the battle of Three Rivers, in June, 1776, he was made prisoner, and, though soon paroled, was not exchanged until May, 1778. He became a brigadier-general May 12, 1779, serving with Lord Stirling on his expedition against Staten Island, and with General Wayne at Bulls Ferry, in July, 1780. In 1782-83 he had command at Fort Pitt of the troops for the defense of the western frontier, and in 1785 acted as agent of his State for the distribution of the public lands among the soldiers. During his term of office he recommended the purchase of the 'triangle' tract, which gave Pennsylvania her outlet on Lake Erie. He was elected to Congress in 1786, and was made one of a commission of three to adjust the accounts of the Confederation with the various States. He also was a member of the convention called to revise the State Constitution, and of that by which the Federal Constitution was ratified for Pennsylvania. From 1793 to 1795 he was again a member of Congress, and in 1794, during the Whisky Insurrection (q.v.), commanded the Pennsylvania militia. He subsequently removed to Philadelphia, and at the time of his death was president of the Pennsylvania branch of the Society of the Cincinnati.

IRVING, ẽr'vĭng, EDWARD (1792-1834). An eloquent and distinguished Scotch clergyman. He was born at Annan, Dumfriesshire, August 4, 1792. He studied at the University of Edinburgh, and, after completing his curriculum for the ministry, became a school-teacher at Haddington and later at Kirkaldy. At the former place, one of his pupils was Jane Welsh, and at the latter began his friendship with her future husband, Thomas Carlyle. His early attempts at preaching were not successful. But in 1819 he became assistant to Dr. Thomas Chalmers in Glasgow. Here he felt himself overshadowed by his more famous colleague, and in 1822 he accepted a call to the Caledonian Church, Hatton Garden, London. His success as a preacher in the metropolis was unparalleled. In brief time he transformed a poor and obscure congregation into a rich and fashionable one, and exchanged the humble chapel for a handsome structure on Regent Square. In 1823 he published his first important work, *The Oracles of God: Four Orations, with an Argument on Judgment to Come.* At the close of 1825 he began to announce his convictions in regard to the second personal advent of Christ, which he declared to be near at hand. This was followed by his translation of a Spanish work, *The Coming of the Messiah in Glory and Majesty*, which professed to be written by a

Christian Jew, Juan Josafat Ben Ezra, but was in reality the composition of a Spanish Jesuit, Manuel Lacunza. In 1828 appeared his *Homilies on the Sacraments.* He now began to elaborate his views of the incarnation of Christ, asserting the doctrine of His oneness with man in all the attributes of humanity. The language which he used on this subject drew upon him the accusation of heresy, to which he gave little heed. He was deep in the study of the prophecies; and when the news came to London in the early part of 1830 of certain extraordinary manifestations of prophetic power in the west of Scotland, Irving was prepared to believe them. (See CATHOLIC APOSTOLIC CHURCH.) Irving was arraigned before the Presbytery of London in 1830, and convicted of heresy; ejected from his new church in Regent Square in 1832; and finally deposed in 1833 by the Presbytery of Annan, which had licensed him. The majority of his congregation adhered to him, and gradually a new phase of Christian order and worship was developed, commonly known as Irvingism, though Irving had really very little to do with its development. Shortly after, his health failed, and, in obedience, as he believed, to the Spirit of God, he went to Scotland, where he sank a victim to consumption. He died at Glasgow, December 7, 1834. Irving's works were published in London (5 vols., 1864-65). Consult: Carlyle, *Miscellaneous Essays and Reminiscences* (London, 1881); *Letters and Memorials of Jane Welsh Carlyle* (London, 1883); and Mrs. Oliphant, *Life of Edward Irving* (London, 1862).

IRVING, Sir HENRY (1838-1905). A distinguished English actor and manager. He was born at Keinton, Somersetshire, February 6, 1838, his name being originally John Henry Brodribb; his stage name of Irving was legalized by royal license in 1887. He was carefully educated at a private school and then placed in a commercial situation, but he early began preparing himself for a dramatic career, and made his first appearance on the professional stage at Sunderland in 1856. After playing in Edinburgh, Glasgow, Manchester, and elsewhere, not without meeting frequent discouragements, he appeared in 1866 at the Saint James's Theatre in London. He soon became noted as an interpreter of light comedy parts, and more especially as the 'heavy villain' in such rôles as Robert Macaire and Bill Sikes. But his first great success was as Digby Grant in the comedy of *Two Roses* (1870), which he performed at the Vaudeville Theatre for three hundred consecutive nights. In November, 1871, he was engaged by the Lyceum Theatre, and increased his reputation by his appearance in *The Bells*, as Mathias (1871), in *Eugene Aram* (1873), *Richelieu* (1873), and *Hamlet* (1874). The peculiarities of his style in *Hamlet* excited great difference of opinion among the critics, which continued over his rendering of *Macbeth* (1875) and *Othello* (1876, and again with Edwin Booth in 1881), but the importance of his position constantly increased. His *Richard III.* (1877) and his *Louis XI.* (1878) attracted great admiration. In 1876 he made a tour through Scotland, Ireland, and the provinces. The withdrawal of Mrs. Bateman from the management of the Lyceum gave Mr. Irving, in 1878, entire control over the theatre in which he had long been the leading attraction; he secured Miss Ellen Terry, and the history of the Lyceum from that time until 1902 was chiefly theirs. Mr. Irving as a manager was famous for the carefully elaborate stage setting of his productions, while as an actor he was distinguished for the psychological force of his characterizations. His theatre became in all its appointments and in the class of the plays produced there the most admirable of London playhouses, though its financial success left something to be desired. In 1899 the Lyceum passed into the hands of a limited liability company, though still under Irving's direction. In the long list of rôles which he assumed after his management began were Shylock (1879); Benedick, in *Much Ado About Nothing* (1882); Mephistopheles, in *Faust* (1885), which proved one of the most popular of his presentations, though critically less admired; Becket (1893), in Lord Tennyson's drama, which he rearranged for the stage, and Robespierre (1899), in the play written for him by Sardou.

He first came to the United States, with Miss Terry and the other members of his company, in 1883, when he made his New York début as Mathias, in *The Bells.* The welcome which he won on this first visit was frequently repeated, and he reproduced in the United States most of his London successes. Mr. Irving was knighted in 1895. He was also known as a writer and public speaker. Among his publications is *The Drama: Addresses* (London, 1892). The "Irving Edition" of Shakespeare (edited by Henry Irving and Frank A. Marshall) appeared in 1887-90 (London).

Irving married, in 1869, Miss Florence O'Callaghan, and his sons, Henry Brodribb Irving and Lawrence Irving, both of whom are actors, have attained some note in literature as well as upon the stage. The former is the author of the *Life of Judge Jeffreys* (1898) and *French Criminals of the Nineteenth Century* (1901); the latter, of the plays *Peter the Great* (produced at the Lyceum, London, 1898) and *Richard Lovelace* (Garden Theatre, New York, 1901).

Consult: Hiatt, *Henry Irving, a Record and a Review* (London, 1899); Fitzgerald, *Henry Irving, Twenty Years of the Lyceum* (ib., 1893); Daly, *Henry Irving in England and America, 1838-84* (ib., 1884); Russell, *Irving as Hamlet* (ib., 1875); Archer, *Henry Irving, Actor and Manager, a Critical Study* (ib., 1883); Brereton, *Henry Irving, a Biographical Sketch* (ib., 1883); Hatton, *Henry Irving's Impressions of America* (ib., 1884); Scott, *The Drama of Yesterday and To-Day* (ib., 1899).

IRVING, ISABEL (1871—). An American actress, born at Bridgeport, Conn. She first appeared upon the stage in 1887, in *The Schoolmistress*, at New York, and the next year became a member of Daly's company, with which she continued till 1894. She became in 1897 John Drew's leading woman, with him appearing in *The Liars* (1898), *The Tyranny of Tears* (1899), and other pieces. In 1901 she played in *To Have and to Hold.* At the beginning of 1902 she became leading woman in William Faversham's company. She was married in October, 1899, to W. H. Thompson. Consult Strang, *Famous Actresses of the Day in America* (Boston, 1899).

IRVING, JOHN BEAUFAIN (1826-77). An American genre painter, born in Charleston, S. C. He was a pupil of Leutze at Düsseldorf, and afterwards lived in his native city and in New

York City. He was elected to the National Academy in 1872. His subjects are usually interiors, with carefully painted figures, in old-time costume. His works include "The Splinter;" "Wine Tasters" (1869); "The End of the Game;" "Cardinal Wolsey and His Friends" (1876); and "A Banquet at Hampton Court in the Sixteenth Century." He also painted portraits.

IRVING, Roland Duer (1847-88). An American geologist, born in New York City. After completing his education at the School of Mines of Columbia University, he was made assistant on the geological survey of Ohio and in 1870 was appointed professor of geology and mineralogy in the University of Wisconsin, where he was also assistant State geologist (1873-79). In this connection he published *Geology of Central Wisconsin* (1877); *Geology of the Lake Superior Region* (1880); *Crystalline Rocks of the Wisconsin Valley* (1882); and *Mineralogy and Lithology of Wisconsin* (1883). In 1882 he was put at the head of the Lake Superior division of the United States Geological Survey, and his important reports were published by the Government: *The Copper-Bearing Rocks of Lake Superior* (1883); *On Secondary Enlargements of Mineral Fragments in Certain Rocks* (1884); and *The Classification of the Early Cambrian and Pre-Cambrian Formations* (1886).

IRVING, Washington (1783-1859). An American author. He was born in New York City, April 3, 1783. His mother was English and his father had come from Scotland to New York City, where he engaged in trade. Irving studied in the schools of New York, and at the age of sixteen took up law. Before he was twenty he contributed, under the pseudonym of 'Jonathan Oldstyle,' to the New York *Morning Chronicle*, of which his brother was editor. Never in good health, he was obliged in 1804 to go to Europe, where he remained two years. Shortly after his return, he published in 1807 with his brother William and James K. Paulding (q.v.), *Salmagundi, or the Whim-Whams and Opinions of Launcelot Langstaff, Esq.*, an undertaking in the style of Addison's *Spectator*. In 1809 appeared *A History of New York from the Beginning of the World to the End of the Dutch Dynasty, by Diedrich Knickerbocker*—a humorous, whimsical, and genially satirical sketch, which brought him reputation and money. This book had been begun with the intention of burlesquing a pretentious guide-book by Dr. Samuel Mitchell. The *Knickerbocker History*, to give it its most common name, grew as Irving's humor found more and more curiosities in the quaint and phlegmatic Dutch type, which is so strongly contrasted with the quick and more volatile descendant of British stock. He then gave up any idea of law, and became a sleeping partner of his brothers, whose business house was in Liverpool, occupying himself meanwhile with literary work. Irving's reputation had preceded him to England, where his gracious manners made him a favorite in society. He met Campbell and Thomas Moore and was heartily liked by Walter Scott, who persuaded Murray to publish *Geoffrey Crayon's Sketch-Book*. Among other things, he edited *The Poetical Works of Thomas Campbell*. During the War of 1812 he was on the staff of Governor Tompkins, of New York, and was connected with the *Analectic Magazine* of Philadelphia. In 1815 he went to Europe to look out for the business interests of the firm, the failure of which in 1818 turned him for good and all to literature.

In 1819, in New York, and in 1820, in London, Irving published the book by which he is most popularly known, *The Sketch-Book of Geoffrey Crayon, Gent.* It was heartily welcomed on both sides of the Atlantic, and two of the stories especially, *Rip Van Winkle* and the *Legend of Sleepy Hollow*, have become classics in American literature. The *Sketch-Book* soon went through many editions, was illustrated by Caldicott and commentated by Pfundheller for the Germans. The vein of the book is one of humor, tenderness, geniality, and good-fellowship; the manner is reminiscent of Goldsmith and other English authors of the eighteenth century, to whom Irving was temperamentally drawn. In 1822 appeared another volume in much the same manner, *Bracebridge Hall, or the Humorists*, a series of sketches, translated by Spiker into German in 1826. In 1822 he visited the Rhine, lived for a while in Paris, and again in England in 1824. In 1824 appeared the *Tales of a Traveller*, a collection of short stories, with the same general good feeling, but with more action. In 1826 Irving went to Spain, remaining there until 1829, and, as a result of his stay, produced four books quite different from his former work: *History of the Life and Times of Christopher Columbus* (1828); *A Chronicle of the Conquest of Granada* (1829), an interesting narrative, but of no real historical value; *Voyages and Discoveries of the Companions of Columbus* (1831); and *The Alhambra* (1832), a series of sketches and stories associated with the author's life in the romantic ruins of Granada. Irving's book on Columbus was written with the help of Spanish archives, after Irving had given up his original purpose to translate Navarrete's recently published work on the discoverer. *The Chronicle of the Conquest of Granada* purports to be founded on the manuscripts of Fray Antonio Agapida, an imaginary chronicler. *The Alhambra* was written mainly in London, where Irving was secretary of the United States Legation from 1829-31. He returned to America in 1832, where he was welcomed with almost national honor; for the people of the United States thought, with good grounds, that he had won recognition abroad of American literature.

In 1841 Irving was appointed United States Minister at Madrid, where he lived from 1843 to 1846, continuing his historical writing with the work on Mahomet. He passed the rest of his life, with the exception of some months of travel in the West, at Sunnyside, his country-seat near Tarrytown, N. Y. Up to 1849 his literary work was inferior to what he had previously done, and is of little value. It consists of *The Crayon Miscellany* (1835); *Astoria* (1836); and *The Rocky Mountains: or, Scenes, Incidents, and Adventures in the Far West* (1837). The work which came toward the end of his life, however, added to his reputation. It was chiefly biographical and historical: *Oliver Goldsmith* (1849); *Mahomet and His Successors* (1849-50); *Wolfert's Roost* (1855); and his long-planned and affectionate *Life of Washington* (1855-59), which he completed only with the year of his death. He died at Irvington, N. Y., November 28, 1859. Posthumously there appeared *The Life and Letters of Washington Irving* (1862-63) and

Spanish Papers and Other Miscellanies (1866), edited by his nephew, P. M. Irving. His *Works*, in twenty-seven volumes, appeared in New York in 1884-86. Selections from them in English and in German, with illustrations by Ritter and Camphausen, were published in Leipzig in 1856.

Irving is significant in the history of American letters as the first American, after the independence of the United States, to obtain real literary recognition in England. His success, both at home and abroad, he owed to the geniality of his nature, his social gifts, and his literary feeling, all of which enabled him to please an audience schooled in the manner of Addison, Johnson, and Goldsmith, and at the same time to cause no offense to the patriotic sensibilities of his countrymen. Much of his work deals directly with English life and customs, and is written in the manner of a kindly, well-bred Englishman. The influence of Irving upon American letters was hence, in the main, good; it enabled writers to make use of the best English tradition and helped to rid them of the provincialism which had characterized their work up to his coming. He is perhaps best as an essayist, and he will be permanent for his charm and refinement; yet it must not be forgotten that he was practically the discoverer, for Americans at least, of the effectiveness of the short story as a form of art. Nor is Irving's place in English literature unimportant, for he was a link between Goldsmith and Dickens. Indeed, Irving seems rather like an English than like an American author; for, though there is a quaintness in his humor and freshness in his views, he is devoted to English traditions as to form. With Whitman, Bret Harte, and Mark Twain one encounters a more obviously American school.

BIBLIOGRAPHY. A fair amount of commentary on Irving exists. In addition to the biography by his nephew, there are Bryant's *Discourse on the Life, Character, and Genius of Washington Irving* (New York, 1860); Longfellow's *Address Before the Massachusetts Historical Society* (Boston, 1870); Laun's *Washington Irving: Ein Lebens- und Charakterbild* (Berlin, 1870); a *Life* in the "American Men of Letters Series," by C. D. Warner (Boston, 1881); and critical discussions of his work are to be found in the literary histories, such as Beers, *Initial Studies in American Letters* (New York, 1892); Richardson, *American Literature* (ib., 1887-88); Wendell, *A Literary History of America* (ib., 1900), and others.

IRVING, WILLIAM (1766-1821). An American author, brother of Washington Irving, born in New York City. He was engaged in fur-trading with the Indians in the region of the Mohawk River from 1787 to 1791, and in 1793 established his business in New York City and married a sister of his brother's collaborator, James K. Paulding. He was a popular member of the literary coterie which flourished in New York early in the last century; and his many poems and contributions to *Salmagundi* mark him as among the best of early American humorists. From 1814 to 1819 he was a Democratic member of Congress.

IR′VINGITES. See CATHOLIC APOSTOLIC CHURCH.

IR′VINGTON. A town in Essex County, N. J., adjoining Newark, of which it is a residential suburb (Map: New Jersey, D 2). It has smelting-works, and manufactures of novelties, wall-paper, etc. Settled as early as 1666, Irvington was first incorporated in 1898. The government is administered by a town council, the members of which, with the exception of the councilman-at-large, are elected by wards. Population, in 1900, 5255.

IRVINGTON. A village in Westchester County, N. Y., 23 miles north of New York City; on the Hudson River, and on the New York Central and Hudson River Railroad (Map: New York, G 4). It is a beautiful place of residence. Prominent among its features of interest are the handsome town hall with the Guiteau Library, and 'Sunnyside,' the home of Washington Irving. Population, in 1890, 2229; in 1900, 2231.

IRWIN, ẽr′wĭn, JOHN (1832-1901). An American naval officer, born in Pennsylvania. He entered the Naval Academy in 1847 and became passed midshipman in 1853. He served on the frigate *Wabash* in the Civil War, and took part in the battle of Port Royal, S. C. Irwin also participated in the engagements at the forts at Hatteras Inlet and Forts Walker and Beauregard. At the capture of Fort Pulaski he received special mention in the report of the battle sent to the Navy Department. During his career he was advanced through the various ranks of the service until, in 1891, he was made a rear-admiral. He retired April 15, 1894.

IRWIN, MAY (1862—). An American actress, best known in 'farce-comedy.' She was born at Whitby, Ont., and made her appearance on the stage at Buffalo early in 1876. Coming to New York, she played for several years at Tony Pastor's Theatre; then became a member of Daly's company, with which she remained until 1887. More recently as a star she has appeared in *The Widow Jones; The Belle of Bridgeport; Madge Smith, Attorney; Kate Kip, Buyer;* and other light pieces. Consult: Strang, *Famous Actresses of the Day in America* (Boston, 1899); Hapgood, *The Stage in America, 1897-1900* (New York, 1901).

ISAAC, Ī′z*ak* (Heb. *Yiṣḥāḳ*, from *ṣāḥaḳ*, to laugh). One of the three Hebrew patriarchs. The story of Isaac is given in Gen. xviii.-xxxv. He was the son of Abraham and Sarah, born to them when Abraham was one hundred and Sarah ninety years old. The connection of the name with the root 'to laugh' is explained in three different versions. When the birth of Isaac is foretold by the angels, *Sarah* is reported to have laughed (Gen. xviii. 12); another account says it was *Abraham* who laughed (Gen. xvii. 17-19); the third says *every one who heard of it* would laugh (Gen. xxi. 6). When the child was eight days old he was circumcised (Gen. xxi. 4), and as he grew older he was a good deal with Ishmael, his half-brother. This displeased Sarah, and she had Hagar and her son driven forth (Gen. xxi. 9 sqq.). The next that we hear of Isaac is in the episode of the offering (Gen. xxii.). In obedience to divine prompting, Abraham set out with his son for Mount Moriah (see EBAL AND GERIZIM), and there attempted to sacrifice the lad as a burnt offering. An angel interposed and a ram was substituted. After the death of his mother Isaac married Rebekah, his kinswoman, brought by Eliezer, the servant of Abraham, by his master's command from Mesopotamia (Gen. xxiv.). Isaac was then forty years of age. After twenty years two sons were born, Esau and Jacob. The sons were different in character, with the result that Isaac loved Esau better, while Rebekah loved Jacob (Gen. xxv. 21-34). When a famine came upon the land of Canaan, Isaac was warned of God not to go down to Egypt, but to go to Abimelech, King of Gerar. Here he practiced the same deceit as his father before him, saying that his wife was really his sister. He prospered greatly in the land and excited the envy of the inhabitants, who twice took away the wells that he had digged. A third well was left unmolested and he called it Beersheba (Gen. xxvi.). In his old age Isaac became blind, and, fearing that he was soon going to die, was anxious to bless his favorite son Esau. By dressing in hairy garments Jacob was able to deceive his father and received the blessing intended for his brother. In consequence of this Jacob had to leave home, but not before he had received a second blessing from his father (Gen. xxvii.). Isaac lived one hundred and eighty years, long enough to see his son deceived by his children when they sold their brother Joseph. He was buried by Jacob and Esau in the cave of Machpelah (Gen. xxxv. 29; xlix. 31).

It is the opinion of many scholars at the present time that Isaac is a tribal name, and the theory is plausible that the full name was once *Yiṣḥaḳ-El*, i.e. El (or god) laughs. The tribal character has, however, been so entirely obscured by the exuberant legendary growth around a supposed personality that it is difficult to determine where the home of the tribe lay; it may with some probability be located about Beersheba, which is more specifically associated with Isaac, as Hebron is with Abraham and Bethel with Jacob. The tribe, or its offshoots, became one of the elements that formed the Hebrew confederacy, and the stories of the three patriarchs, Abraham, Isaac, and Jacob, represent merely the gradual coalition of traditions existing among the clans which were united in the confederacy known as *Bene Israel* or Israelites.

Scholars who accept the composite character of the present Book of Genesis believe that the Isaac narrative contains: (a) specimens of Hebrew folk-lore, as the story of Isaac's birth, and the play upon his name, 'the laughter;' (b) a bit of religious doctrine in the story of the sacrifice, illustrating at once the proper attitude of the pious Yahweh-worshiper, which is also found in the Pentateuchal codes, against human sacrifice; (c) traditions of the wanderings of some of the Hebrew tribes during the nomadic period of primitive Semitic culture.

In the accounts of Isaac's birth there is a deliberate attempt to modify tradition so as to make it appear that Isaac is the legitimate and 'only' son of Abraham. The claims of Ishmael (q.v.), who is the older, cannot be altogether set aside, but the distinctively Hebraic point of view is brought out, not only by making Isaac the offspring of Sarah—the true wife of Abraham—but by the elaborate account of the promise made to Abraham that he should have a son by Sarah, despite the latter's great age, and by the emphasis laid upon the joy that Isaac's coming occasioned on all sides. The setting aside of Ishmael to make room for Isaac reflects the separation of the Ishmaelite clan or clans from the Hebrews. Ishmael not having formed an element in the Hebrew confederacy, the very closeness of the bond between the two as preserved by tradition even among the Hebrews becomes the motive for transforming these traditions in such a manner as to present Ishmael in as unfavorable light as possible. Hence in the most important incident of the Isaac narrative, the journey of Abraham and Isaac to the place of sacrifice, Isaac is not only called the beloved but the only son of Abraham, with the evident intent of ignoring Ishmael altogether. The story of Isaac's sacrifice may be a genuine Jewish midrash, not based at all upon popular tradition, but deliberately introduced as a *mashal* or allegory to illustrate Abraham's implicit obedience to Yahweh. Abraham in this story is the type of the true and pious Yahweh-worshiper, according to the ideas of exilic writers. The place to which father and son go is Mount Moriah, i.e. the temple mount, and critics are generally agreed that this manner of localization betrays the hands of a Judaite, who desired not only to present the allegory, but also to add to the claims of Jerusalem as the central and only legitimate sanctuary of Yahweh. The main point of the allegory is to confirm the attitude of the Pentateuchal codes, which oppose human sacrifices, but recognize animal offerings as an indispensable feature of the cult.

When we come to the wanderings of Isaac from Rehoboth to Gerar, and from Gerar to Beersheba, and the quarrels over the wells, we are again in the presence of popular traditions regarding the nomadic period, to which, however, a religious turn has been given by the compilers of the tradition in making Isaac a type of the mild and peace-loving Israelite; and once more the artificial (though also artistic) character of the Isaac narrative is revealed in making Isaac die at Mamre-Hebron (Gen. xxxv. 27), in order to locate his burial-place in the cave of Machpelah with Abraham, whereas Isaac's real home is Beersheba. As for the stories of Isaac's relationship to his two sons, Esau and Jacob, they reflect again the rivalry between Edom and Israel. (See JACOB.) Consult the commentaries on Genesis (see GENESIS, BOOK OF), chapters xviii.-xxxv.

ISAAC, SACRIFICE OF. (1) A painting by Rembrandt, in Saint Petersburg. (2) A fresco by Raphael in the Vatican.

ISAAC I., COMNE'NUS (?-1061). Byzantine Emperor from 1057 to 1059. He was the first of the line of the Comneni to ascend the throne, though his family had been for some time prominent in both military and civil capacities. In 1057 he was proclaimed Emperor by the landed aristocracy in opposition to Michael VI., whom he defeated and deposed. On his accession he found the affairs of the Empire in a very bad condition; rebellion within, aggression without, and the treasury exhausted. He succeeded in establishing a system of great economy in all branches of the administration, and, in order still further to lighten the burden of taxes on the people, called upon the clergy to contribute their share. But the clergy refused to endure the imposition of any such burdens, and the Patriarch Michael is reported to have even threatened him with deposition. Death delivered Isaac of this formidable opponent, and the clergy were compelled to submit. In 1059 he repelled the Hungarians, who had encroached upon his possessions in the northwest, but soon afterwards he was attacked by a violent fever, and, believing his death approaching, appointed his famous general, Constantine Ducas, as his successor. He recovered from his illness, but nevertheless resigned the crown and retired to a convent, where he died after two years. Isaac was not deficient in literary attainments. We still possess his *Scholia* on Homer, his favorite author; further, a work, *Characteristics*, dealing with the Greek and Trojan chiefs mentioned in Homer; and, finally, a treatise entitled *On the Works of Homer*. Consult Oman, *The Byzantine Empire* (London, 1892).

ISAAC II., ANGELUS (?-1204). Byzantine Emperor from 1185 to 1195 and 1203-04. Delivered by a popular revolution from death, to which he had been condemned by his kinsman, Andronicus Comnenus, Emperor of Constantinople, he obtained the throne in 1185. His vices, incapacity, and military disasters rendered him unpopular, and he was dethroned, blinded, and shut up in a monastery by his brother Alexius III., in 1195; but was restored by the Crusaders, who took Constantinople in 1203, only to be again dethroned by Alexius Ducas in 1204. He died soon after. Bulgaria was lost to the Byzantine Empire during his first period of power in 1186.

ISAAK, ē′zȧk, **IZAK**, or **YZAC**, HEINRICH (c.1450-c.1517). A German-Italian musician. We know nothing of his life except that he was in the service of Lorenzo de' Medici for a number of years; was organist in Rome; and later was 'symphonista regis' to Maximilian I. at Vienna. He was a prolific composer of the contrapuntal school, and was one of the first to employ the melody in the soprano. His compositions were frequently reprinted in collections, and some of his part-songs and melodies (notably the choral "Nun ruhen alle Wälder") are still in use.

ISABELA, ē′sȧ-bä′lȧ. A province in Luzon, Philippines. It takes in part of the Sierra Madre and the Carballos Mountains. A large part of its area is covered with thick forests peopled by savage tribes. Live stock are raised extensively, and tobacco is cultivated. Its area is 4467 square miles; its population in 1899 was 54,000. Capital, Ilagan (q.v.).

ISABELA. A town of Negros, Philippines, in the Province of Eastern Negros. (Map: Philippine Islands, G 9). Population, in 1898, 11,100.

ISABELLA, ĭz′ȧ-bĕl′lȧ (1) In Ariosto's *Orlando furioso*, the daughter of the King of Galacia, in love with Zerbino, slain by Rodomont. (2) In Shakespeare's *Measure for Measure*, the sister of Claudio, pursued by the base passion of Angelo, but delivered from him by Duke Vincentio. (3) In Kyd's *Spanish Tragedy*, the wife of Hieronimo. (4) In Massinger's *Duke of Milan*, the mother of Ludovico Sforza. (5) In John Webster's tragedy *The White Devil*, the wife of the Duke of Brachiano. (6) The Countess in Marston's tragedy *The Insatiate Countess*. (7) In Southern's tragedy *The Fatal Marriage*, the nun who marries Biron. After his supposed death she marries Villeroy, and on Biron's return kills herself. The part of Isabella affords great scope for a tragic actress and was often played by Mrs. Barry, Mrs. Siddons, and others. (8) A character in Mrs. Centlivre's comedy *The Wonder*. (9) A character in Young's tragedy *The Revenge*. (10) In Meyerbeer's opera *Robert le Diable*, the Princess of Sicily, in love with Robert.

ISABELLA; OR, THE POT OF BASIL. A poem by Keats, based on a story by Boccaccio (1818).

ISABELLA. A buff or brown color. The term originated in a story told of Isabella of Austria, daughter of Philip II., at the siege of Ostend (or of Isabella of Castile at the siege of Granada), who vowed not to change her linen before the capture of the town. Owing to the length of the siege, the linen was discolored, and so gave rise to the name.

ISABELLA I., Sp. **ISABEL**, ē′sȧ-bĕl′ (1451-1504). Queen of Castile, known as the Catholic. She was born at Madrigal, Old Castile, the daughter of John II., King of Castile and León, by his second wife, the Infanta Isabella of Portugal. In 1454 Isabella's brother Henry ascended the throne of Castile, and in 1469 the Princess, after considerable opposition and in the face of great difficulties, married Ferdinand of Aragon. On the death of Henry IV., in 1474, she succeeded to the throne of Castile and León, to the exclusion of her niece Joanna. She had won the support of a great part of the estates of the Kingdom during her brother's life, and the victorious arms of her husband compelled the consent of the rest. A war with Portugal, which was waged by King Alfonso in behalf of the Princess Joanna, was terminated in Isabella's favor in 1479, and the same year Ferdinand, who had been created honorary King of Castile, succeeded to the throne of Aragon as Ferdinand V. This union of the two chief Spanish kingdoms laid the foundation of Spain's future greatness. The first task the allied sovereigns set themselves to perform was the pacification and consolidation of the kingdoms of Castile and Aragon. Then in 1482 they began the ten years' war against the Moors of Granada, which culminated with the capture of the Moorish capital and the extinction of Moorish sovereignty in Spain at the beginning of 1492. It was toward the end of this struggle, the danger and hardships of which Isabella shared with her army, that the Queen of Castile earned her greatest title to fame in the eyes of posterity, by her acquiescence in the plans of Columbus, who was then a suppliant at the Spanish Court. For their successes against the Moors and their stanch Catholicism the title of 'Catholic sovereigns' was conferred by the Pope on Ferdinand and Isabella. Queen Isabella was possessed of no inconsiderable beauty and much winning grace, although proud, ambitious, and exceedingly punctilious. She was always present in meetings of the council, and insisted on the use of her name with that of Ferdinand in all public documents. The consolidation of the Spanish Kingdom through the organization of the Hermandad (q.v.) and the establishment of the royal supremacy over the great military orders were in a large measure her work. In the reign of Isabella the Inquisition was organized in Castile by Torquemada, under whom its work was carried on with a barbarity bred of the most fanatical zeal. In 1492 the Jews were expelled from Castile and the rest of Spain, to the great detriment of the country. She died at Medina del Campo on November 26, 1504, and was buried in accordance with her own wishes in the Franciscan monastery at Granada. Of her five children, the two eldest, Isabella, Queen of Portugal, and John, her only son, died in 1498 and 1497 respectively. Of her three remaining daughters, Joanna the Mad became the wife of Philip of Austria and the mother of Charles V. of Germany; Maria married Emmanuel of Portugal; and Catharine of Aragon was the unfortunate first wife of Henry VIII. of England, and the mother of Mary Tudor. Besides the works cited under SPAIN, CASTILE, and FERDINAND, consult: Prescott, *History of the Reign of Ferdinand and Isabella the Catholic, 1479-1516* (London, 1889), the best general work containing full biographical notes; Clemensin, "Elogio de Isabel," in vol. vi. of the *Memorias de la Academia de la Historia*, with biography and letters of Queen Isabella (Madrid, 1820); Nervo, *Isabella la Catholique, reine d'Espagne, sa vie, son temps, son règne, 1451-1504* (Paris, 1884).

ISABELLA II. (1830-1904). Queen of Spain from 1833 to 1868. She was the daughter of Ferdinand VII. by his fourth wife, Maria Christina of the Two Sicilies, and was born at Madrid, October 10, 1830. By a decree which set aside the Salic law in Spain and which was confirmed by the Cortes, March 29, 1830, the Infanta Isabella became the heiress apparent to the throne, which she ascended on the death of her father in September, 1833, her mother being appointed Queen Regent. An insurrection in favor of her uncle, Don Carlos (q.v.), who according to the Salic law would have succeeded to the throne on the death of his brother, immediately broke out and raged with great violence until 1840, when the cause of the Court triumphed. In the course of the period politicians had begun to divide into the two parties of the *Moderados*, or Conservatives, and the *Exaltados*, or Liberals; and the Queen Regent found it necessary to enlarge the liberal Constitution in 1834, and ultimately (1836) to reëstablish the Constitution of 1812. In 1840 Maria Christina, after making Espartero, the champion of the Court in the war over the succession, Prime Minister, was reduced to the necessity of resigning the regency, which was conferred on Espartero. An insurrection broke out in 1843, which led to the overthrow of the Regent Espartero and the establishment of the military dictatorship of Narvaez, who introduced an antiliberal policy. On November 8, 1843, Queen Isabella was declared by the Cortes to have attained her majority. Although the young Queen enjoyed personal popularity, political intrigues continued, with frequent attempts at insurrection. In 1846 the Queen married her cousin, Don Francisco d'Assisi, elder son of Ferdinand VII.'s youngest brother. A change to almost purely absolute government in 1853 was followed by the banishment of many chiefs of the Constitutional Party, as a result of which a formidable rising of the army took place in 1854 under O'Donnell (q.v.). Espartero was put at the head of an administration in which liberal principles held sway. But the Queen disapproved of his policy and he resigned in favor of O'Donnell, July 14, 1856, who was soon after supplanted by Narvaez. For a number of years the chief power was held alternately by these two ministers. Though liberal ministers were more than once forced upon her, the Queen as time went on fell more completely under the influence of the reactionary faction. She lost much of her former popularity, and the nation became impatient under her arbitrary rule. In September, 1868, a revolution broke out, headed by Serrano, Prim, and Topete, ending in the formation of a republican provisional government and the flight of Isabella to France. In 1870 she abdicated in favor of her son, Alfonso XII., who succeeded to the throne in 1875 after the brief reign of Amadeus of Savoy and the failure of the republic under Castelar. After 1871 the ex-Queen of Spain passed the greater part of her time in Paris. See SPAIN.

ISABELLA OF ENGLAND. See EDWARD II.; and EDWARD III.

ISABELLA THE CATHOLIC, ORDER OF. A Spanish order of knighthood, founded by Ferdinand VII., in 1815, as a reward for loyalty in the defense of Spanish American possessions. It is now conferred for all kinds of merit. The sovereign is the head of the order, which is divided into four classes of grand cross commanders of the first and of the second rank, and knights. The badge of the order is an eight-pointed cross of gold inlaid with red enamel, bearing a central plaque with the motto, 'A la lealtad acrisolada'—'to proven loyalty'—and suspended from a laurel crown held by a ribbon of orange and white.

ISABELLE, ė'zȧ'bĕl'. (1) In Molière's *L'école des maris*, the sister of Léonor, trained by Sganarelle to become his wife. She dupes him and marries Valère. (2) A character in Dryden's play *The Wild Gallant*.

ISABEL'LINE GAZELLE. A gazelle of Kordofan and Sennar (*Gazella isabellina*), distinguished from the dorcas mainly by the tail being rufous instead of black above. See Plate of GAZELLES.

ISABELLITA, ē'sȧ'bĕl-lē'tȧ (Sp., little Isabelle). A name in the Spanish West Indies for any of the gaudy fishes of the genus Angelichthys, called also 'angel-fish' and 'emperor-fish' (q.v.).

ISABEY, ė'zȧ'bā'. EUGÈNE LOUIS GABRIEL (1804-86). A French genre and marine painter, son and pupil of Jean Baptiste Isabey (q.v.). He was born in Paris, July 22, 1804. He was much influenced in color by Delacroix, although his art was of a lighter character. His genre pictures represent scenes of a past age, and are painted in delicate and harmonious colors, especially the costumes. His marines show in an admirable manner the glittering evanescent effects of light upon the waves. He received first-class medals in 1824, in 1827, and 1855, and became an officer of the Legion of Honor in 1852. In 1830 he was appointed royal marine painter, and accompanied the expedition to Algiers. He died near Lagny, April 27, 1886. His works include: "A Hurricane at Dieppe;" "Harbor of Honfleur" (1827); "Battle of the Texel" (1839), Versailles Museum; "View of Boulogne Harbor" (1843), Toulouse Museum; "Ceremony in the Church of Delft" (1847); "Marriage of Henry IV." (1848); "Embarkation of De Ruyter and De Witt" (1850), and "Roadstead of Saint Malo," in the Luxembourg Museum; and others in the provincial museums of France and Germany. The Metropolitan Museum of New York possesses his "Banquet Hall" (1873).

ISABEY, Jean Baptiste (1767-1855). One of the greatest French miniature painters. He was born in Nancy, April 11, 1767, and studied chiefly in Paris under David and the miniature painter Dumont. After a hard struggle with poverty he received a commission to paint a medallion of Marie Antoinette. During the Revolution he painted the portraits of a number of the most prominent members of the Constituent Assembly, besides other works, the most important of which were "La Barque d'Isabey," representing himself, his wife, and three children in a boat, and his masterpiece, "General Bonaparte in the Gardens of Malmaison." He was in high favor with Napoleon, for whom he painted hundreds of miniatures for distribution as gifts, and he managed to retain the favor of all successive French rulers. All the reigning sovereigns of Europe were among his sitters. His portraits were true to nature and of great charm. He died in Paris, April 18, 1855. Among his best-known works other than miniatures are the "Congress of Vienna;" the "Table des Maréchaux," a design in porcelain of Napoleon and his marshals; "Napoleon Holding a Review in the Tuileries." Consult Taigny, *Isabey: sa vie et ses œuvres* (Paris, 1859).

ISABNORMAL (ĭs'ăb-nôr'mal) **LINES** (from Gk. *ἴσος*, *isos*, equal + Eng. *abnormal*, from Lat. *abnormis*, abnormal, from *ab*, from + *norma*, rule). Lines connecting places whose temperature, pressure, etc., for any epoch have equal departures from the normal values of the respective places.

ISÆ'US (Lat., from Gk. *Ἰσαῖος*, *Isaios*). A Greek orator of the fourth century B.C., who is included in the Alexandrian canon of the ten Attic orators. Of his life little is known. He was the son of Diagoras, and was probably born at Chalcis, although most of his life was spent at Athens, where he was a contemporary of Isocrates, whose pupil he is said to have been. As he was not an Athenian citizen, he could not plead before the courts, but, like Lysias, he took up the profession of logographer, or writer of speeches for others. His specialty was the laws of inheritance. The ancients had sixty-four speeches which were attributed to him, of which fifty were held to be genuine. Of these only ten have come down to us complete, although the single MS. which contains them has preserved about half of another speech, and Dionysius has a long fragment, which is usually printed as a twelfth oration. Isæus's strength is said by his biographer to have depended on his skillful handling of evidence, in direct contrast with the 'simple style' of Lysias. The speeches are best edited by Bürmann (Berlin, 1883). There is an English translation by Jones, *The Speeches of Isæus* (London, 1779). Consult Blass, *Die attische Beredsamkeit*, part ii. (Leipzig, 1892).

ISAG'ORAS (Lat., from Gk. *Ἰσαγόρας*) (c. 545 - c. 500 B.C.). An Athenian politician. He was chosen first archon (B.C. 508) after the expulsion of Hippias (510), although Clisthenes had been much more influential at the time. In the quarrel which followed Isagoras was opposed by Clisthenes and the entire people, and the new constitution was victorious. But Isagoras appealed to Sparta, and Cleomenes, King of Sparta, insisted that Clisthenes be surrendered, since he was descended from the accursed Alcmæonidæ. The leader of the people voluntarily retired; the Spartans occupied the city; Isagoras banished seven hundred families and attempted to replace the democratic Five Hundred by an aristocratic Three Hundred. At this the people rose, hemmed the Spartans within the Acropolis, and, after three days, permitted them and Isagŏras with them to retire to Sparta, but executed all Athenian partisans of Isagoras, who himself died in exile.

ISAIAH, ī-zā'yȧ *or* ī-zä'yȧ (Heb. *Yesha'ayāhū*, help of Yahweh, or Yahweh helps). One of the most famous of the older Hebrew prophets. He was the son of Amoz and lived at Jerusalem during the reigns of Ahaz and Hezekiah, extending from c. 736 to 693 B.C. We may assume that he was born about B.C. 760, and that he died about B.C. 700. He appears to have occupied a high social position, had easy access to Ahaz, and exerted much influence on Hezekiah. Beyond this we know little of his private life. It appears from his discourses that he was married and had at least two children, to whom (like Hosea, q.v.) he assigned symbolic names (chaps. vii. 3, viii. 3). It is the opinion of modern scholars that but a small proportion of the discourses in the Book of Isaiah (q.v.) emanate from Isaiah himself; and furthermore that not one of these discourses has been preserved in its original form. The so-called Book of Isaiah is a twofold collection of prophecies, and in the first collection alone do we find discourses of Isaiah (e.g. chaps. ii.-x., xvii., xviii., xxii., xxviii.-xxxi., xxxiii.). All of these contain additions belonging to various later periods, and above all have been so radically rearranged that it is exceedingly difficult to fix the chronological order of the portions belonging to Isaiah and to determine the political events to which they have reference. Still some of the discourses are quite clear.

The most important event in the reign of Ahaz was the combination of Pekah, King of Israel, and Rezin of Damascus against Judah (II. Kings xvi.). To this event and its consequences several discourses of Isaiah refer, found in chaps. vii., viii., and xvii., excluding interpolations. The prophet advises Ahaz to be calm and to place his trust in Yahweh. As a matter of fact, the combination against Judah failed, but not until Ahaz had called for aid upon Tiglathpileser, the King of Assyria. This act arouses the prophet's ire. He changes his tone toward Ahaz, denounces his lack of confidence in Yahweh, and predicts havoc and misfortune to the country from these very Assyrians whom Ahaz has called in as allies. And the result was that the northern kingdom of Israel was wiped out, while Judah escaped only by becoming a vassal to the King of Assyria. In the days of Hezekiah, the country chafed under the yoke, and a party arose in Jerusalem which formed an alliance with Egypt as a means of freeing the country from Assyrian suzerainty. Isaiah was equally opposed to this policy. Portions of his discourses during this period are preserved in chaps. xxviii.-xxxi. He declares that the Egyptians and their allies will be defeated, and goes so far as to intimate that Yahweh Himself will fight on the side of Assyria against His own people if they ally themselves with Egypt. Isaiah could not quell the warlike spirit which was rife in

Judah, and the King watched for every chance to oppose Assyria. He not only joined with Egypt, but actually organized a revolt against Sennacherib (see HEZEKIAH), which terminated disastrously for the Judean kingdom, although, by a fortunate turn of events, it escaped being entirely wiped out. At this juncture the leading thought in what may be called Isaiah's theology reveals itself. The terrified ruler and his people in their distress hoped that by entreaties and sacrifices they might again secure the favor of Yahweh, for the calamity that befell the country was looked upon as a sign of Yahweh's displeasure. The first chapter of Isaiah (verses 5-26) gives the prophet's view of the situation. There is only one hope of salvation, and that is by a complete change of conduct on the part of the people, by upright practices and by fair dealings, by honest government and just courts. As for sacrifices, prayers, and festivals, Yahweh hates them. This and other chapters afford an insight into the social conditions prevailing in the days of Isaiah, which is most important for understanding the attitude of the prophet toward political events. He felt deeply that there was actually no hope for Judah unless by a total change of conduct the people might secure once more the favor of Yahweh. Political alliances were of no avail, either with Assyria or with Egypt. He had warned Ahaz, but the warning was not heeded. His influence over Hezekiah was greater. Largely, no doubt, at his instigation, the King undertook some religious reforms, though not to the extent pictured by the compilers of the Books of Kings. (See HEZEKIAH.) But Hezekiah, like Ahaz, yielded to pressure, and put his trust in princes instead of in Yahweh. Isaiah, no doubt sorely disappointed, lost all hope, and became a prophet who foresaw only gloom and woe for his people, declaring that none, whether great or small, would escape the punishment deserved by their shortcomings.

Hence, despite the obscurity in which the personality of the great prophet is enveloped through editorial interference with his productions, enough can be determined to enable us to grasp his essential message in its full force. His watchword is, through right conduct alone can a people be saved, and it is because of the profound impression that this message made—not, indeed, upon his own age, but upon the generations of the Exile and the post-exilic period—that Isaiah became, instead of a real personality, a type of the true prophet of Yahweh, and that discourses of various periods which seem worthy to be associated with Isaiah were grouped with his utterances, and a composite Book of Isaiah was gradually evolved.

ISAIAH, BOOK OF. One of the longest and greatest of the prophetic books of the Old Testament. It is placed first in the writings of the prophets in the English Bible, and is the first of the four so-called greater prophets. Most modern scholars are agreed that the book is a composite structure of an exceedingly complicated character, not the work of one author, but of perhaps half a dozen, or even more. It represents a gradual growth extending through several centuries, and is even more complicated than the Hexateuch (q.v.), although its composition did not occupy so long a period as that of the latter. As early as the latter part of the eighteenth century the theory was put forward that the book consists of two independent works: (1) Chapters i.-xxxix., and (2) chapters xl.-lxvi. By the middle of the nineteenth century this view had been widely accepted. The author of the second section (often called Deutero-Isaiah) has in mind distinctly exilic and post-exilic conditions, and refers to exilic and post-exilic events, such as the permission given by Cyrus—who is mentioned by name—to the Jews to return to Jerusalem. Hence it seems that he cannot possibly be identical with the Isaiah living before the Exile, whose discourses are incorporated in the first section. See ISAIAH.

Further investigation brought forth the theory that both parts of the book consist of several distinct sections, belonging to periods separated from one another by intervals, so that the discourses in the book, if arranged in chronological order, extend from the last half of the eighth century down to the third century B.C. There are still a number of problems connected with Isaiah to be investigated, but the researches of scholars have proceeded so far that they feel justified in saying that not a single discourse of Isaiah has been preserved in the form in which he delivered or wrote it. His work has been rearranged, and additions made to it, reflecting post-exilic views and conditions. Isaiah became the type and model of Hebrew prophecy. His religious point of view appealed to the pious Yahweh-worshipers of the Exile, who felt that events justified the main thesis put forth by the prophet. The popularity that he thus attained in certain circles led to his being amplified, as it were. His discourses, instead of being handed down in their original form, were modified so as to fit in with later conditions, and, as this process went on, the character of the collection naturally took on a totally different form. Moreover, various other discourses, or groups of discourses, that were deemed worthy of a place beside Isaiah were incorporated with him, and thus there was produced a collection which merited the name of Isaiah only because the personality of the prophet overshadowed that of all others whose discourses were joined to his. From the religious point of view, however, Isaiah represented only a part of the whole. He is not a prophet of hope, but rather one who, disappointed in the policy adopted by both Ahaz and Hezekiah, looks forward to a future of gloom and woe. (See ISAIAH.) The prophet of doom needs to be supplemented by the prophet of hope, and hence there was joined to the first Book of Isaiah a second collection, entirely post-exilic in origin, the main themes of which were encouragement to the faithful followers of Yahweh, assurance of God's favor toward the community which sought to regulate public and private conduct and the cult according to divine law, and advice in periods of distress and anguish. While the date of the combination of the two collections cannot be definitely determined, it is safe to assume that the book was put in its present form later than the second half of the third century B.C.

Taking up the two collections, one finds in the first (chaps. i.-xxxix.) the following divisions, corresponding roughly to the component parts of the collection itself: (a) chaps. i.-xii.; (b) xiii.-xxiii.; (c) xxiv.-xxxv.; (d) xxxvi.-xxxix. The general subject of (a) is the political and religious conditions in Judah in the face of the threatened invasion by Israel and Syria, with consideration of the danger threatening both Judah and Israel from Assyria. The bulk of the discourses are from Isaiah, but there have been added introductions and epilogues at various points, and editorial insertions with reference to the Messianic future of Israel, the insertions themselves being at times extracts from prophetical discourses of a late post-exilic date. Chap. i. appears to stand by itself, and contains a general (and very late) introduction to the completed collection. Chaps. ii.-iv. have been pieced together from various discourses and given a Messianic interpretation. Chap. v. is again an independent production. Chaps. vi.-x. are narratives, with fragments of discourses introduced by way of illustration; while chaps. xi. and xii. embody three appendices to the collection, containing (a) a description of the Messiah as the perfect ruler; (b) a reference to the restoration of the exiles of Israel and Judah to their country; and (c) a lyric in praise of Yahweh. The second division (chaps. xiii.-xxiii.) is a collection of ten oracles mostly on the nations around Israel and Judah. These oracles, in which are often interspersed snatches of poems, fragments of oracles, and other insertions, date from different periods, and it cannot be safely maintained that more than five of these (chaps. xiv., xv., xvii., xxii., xxiii.) are based upon predictions of Isaiah. The third division (chaps. xxiv.-xxxv.) is far more complicated than the preceding two. It may be further subdivided into: (a) Chaps. xxiv.-xxvii., a species of apocalyptic prophecy on the coming judgment of the whole world, from which Israel alone will be rescued; the composition of these chapters is by some critics brought down as late as the end of the second century B.C., but it is likely that the conditions involved are those prevailing at the close of the fourth century B.C. (b) Chaps. xxviii.-xxxiii., a series based upon occurrences in the times of Isaiah, but in which only the framework of xxviii.-xxxi. can be considered Isaianic. Chap. xxxii. is a picture of the Messianic age, while chap. xxxiii. contains a denunciation of an invader of Judah in which a section (verses 9-14) may emanate from Isaiah. (c) Chaps. xxxiv.-xxxv. announce Israel's triumph over Edom and exultation over the return of the exiles. (d) The fourth division (chaps. xxxvi.-xxxix.) is an historical epilogue, with a poetic insertion, again consisting of two distinct narratives, and furnishes the historical commentary to the discourses of Isaiah and to some events alluded to therein.

The second book is simpler in its composition. (a) Chaps. xl.-xlviii. set forth the hope of the Babylonian exiles. The period of probation is drawing to an end. Babylon has fallen, and the hopes of the faithful Jews who have learned the hard lesson of the past are centred in Cyrus. (b) Chaps. xlix.-lv., while still dealing with conditions during the Exile, appear to be the work of a different author from chaps. xl.-xlviii. The tone is not so hopeful. Difficulties have arisen in the work of reorganization of the community, and the chief aim of the author is to encourage the zealous workers and to induce Babylonian Jews to join their brethren in Judea. Both sections were written in Babylonia. Inserted in this second section are four songs of the servant of Yahweh, i.e. Israel as represented by its best exponents, which have been attached to the discourses by a later editor. (c) Chaps. lvi.-lxvi. are more complex in character than the two previous divisions, and represent productions belonging mainly to the age of Nehemiah, though some sections (e.g. the prayer, lxiii. 7-lxiv.) point to a still later period of Persian supremacy in Palestine. It is occupied with the difficulties encountered by Nehemiah and Ezra, and presents the point of view of the uncompromising adherent to Yahweh's law. The combination of these sections into a single collection was probably made at the close of the fourth century B.C., somewhat earlier, therefore, than the date that may be assigned for the other collection. The reference in Ecclus. (xlviii. 22-25, c. 180 B.C.) to the Book of Isaiah in the form in which we have it furnishes a positive limit for the final combination and redaction of the two collections into a single work.

BIBLIOGRAPHY. The literature on the Book of Isaiah is very extensive. A good bibliography may be found in the commentary by Skinner in the *Cambridge Bible for Schools and Colleges* (Cambridge, 1896-98). Other excellent commentaries are those by Cheyne, Duhm, Dillmann, Delitzsch, Kittel, Marti, and G. A. Smith. Consult, also, the Old Testament introductions of Kuenen, Driver, Bleek-Wellhausen, and Kautzsch, and, for a particularly full discussion of the critical problems, Cheyne, *Introduction to the Book of Isaiah* (London, 1895).

ISANOMALOUS (Is'ȧ-nŏm'ȧ-lŭs) **LINES** (from Gk. *ἴσος*, *isos*, equal + Eng. *anomalous*, from Lat. *anomalus*, Gk. *ἀνώμαλος*, *anōmalos*, uneven, from *ἀν*, *an-*, priv. + *ὁμαλός*, *homalos*, even, from *ὁμός*, *homos*, same, Skt. *sama*, Goth., OHG. *sama*, Eng. *same*). Lines connecting places whose temperatures, pressures, etc., have equal departures from the average values appropriate to the respective zones of latitude. This term was first introduced by Dove.

ISAR, ē'zär. A tributary of the Danube. It rises in Tyrol, a few miles north of Innsbruck, and, breaking through the Alps, enters Bavaria, where it flows at first north past the city of Munich, and then northeast, joining the Danube near Deggendorf (Map: Germany, D 5). Its total length is about 182 miles. Owing to its numerous falls and scarcity of water at certain points, the Isar is of little importance as a commercial waterway and is used mostly for the floating of timber.

IS'ARD, or **IZ'ARD** (Fr., from Catalan *isart*, chamois, perhaps of Iberian origin). The chamois of the Pyrenees—a smaller form, with shorter horns and a more foxy-red color than the typical 'gemse' of the Alps. See CHAMOIS.

ISAROG, ē'sȧ-rōg'. One of the principal peaks of the island of Luzon, Philippines, situated in the southeastern part of the island in the Province of South Camarines, and occupying the isthmus between the Bay of San Miguel and that of Lagonoy. It is an isolated extinct volcano. Its height is 6450 feet; its base is 36 miles in circumference, and numerous streams have their sources on its slopes.

ISAURIA, ī-sa̤'rĭ-ȧ (Lat., from Gk. *Ἰσαυρία*). The ancient name for a region in Asia Minor on the north side of Mount Taurus between Cappadocia, Lycaonia, Cilicia, and Pisidia. The Isaurians were a half barbarous people, living by plunder. They displayed an indomitable spirit from the earliest times, and with their Cilician neighbors they ravaged the Eastern waters with their piracies. In B.C. 78 they were reduced to a temporary submission by the Romans, but soon renewed their raids. The Romans endeavored to surround their country with a chain of fortresses. In the third century A.D. they formed one nation with the Cilicians, and one of their number proclaimed himself Roman Emperor, but was put to death. A native of Isauria, Zeno, was Byzantine Emperor at the time of the fall of the Western Empire. The capital, Isaura, at the foot of Mount Taurus, the only important city, was a large, rich, and well-fortified place. It was burned, together with its inhabitants, by the Isaurians when unable to withstand the siege of the Regent Perdiccas, in the fourth century B.C. The country was rocky and barren, producing chiefly the vine, which was cultivated with care.

ISCHIA, ês′kê-ȧ. An island of Southern Italy, lying between the Bay of Naples and the Gulf of Gaeta, seven miles southwest of Cape Miseno, the nearest point of the mainland (Map: Italy, H 7). Area, 17½ square miles; population (1901), 26,891, chiefly engaged in the manufacture of pottery and straw hats and in fisheries. It is of volcanic origin, and is rocky and mountainous throughout, the highest point being the volcano Epomeo. Nevertheless it is very fertile, and is famous for its wine, as well as for its exquisite scenery and climate, which make it one of the favorite resorts of tourists. It is connected by steamers with the mainland. It markets white wine and fruit. The largest town is Forio, on the west coast, while the one most visited by tourists is Casamicciola, famous for its hot mineral springs. Ischia is the capital. The island was first settled by Greek colonists, who abandoned it on account of its dangerous volcanic activity. It has been a number of times visited by earthquakes, especially in 1883, when the towns of Forio, Casamicciola, and Lacco Ameno were destroyed, and several thousand persons killed.

ISCHL, ĭsh′′l. A celebrated watering-place, in the Crownland of Upper Austria, picturesquely situated in the centre of the Salzkammergut, over 1500 feet above the sea-level, on a peninsula formed by the rivers Traun and Ischl, 28 miles east-southeast of Salzburg (Map: Austria, C 3). It has a fine parish church, a Kurhaus, a theatre, and a number of fine villas, including a royal villa. There are salt and sulphur springs, mud, pine-needle, vapor, and other baths, and a hydropathic establishment. Ischl is the summer residence of the royal family, and is well patronized by the Austrian nobility as well as by foreigners, the annual number of guests being about 25,000. In the vicinity are extensive saltworks, from which the brine is conducted to Ischl and there evaporated. Population of the commune, in 1900, 9646.

ISÉ, ē′sâ. One of the central provinces of Japan, bordering on Owari Bay, and adjoining Yamato on the west. It is included in the Prefecture of Miye, and contains several busy towns, the chief of which are Tsu, 25,000 inhabitants; Yamada, 23,000; and Kuwana, 20,131. Near Yamada are the celebrated Shinto shrines, called by the Japanese *Rio-dai-jin-gu*, 'Two-great-divine-temples,' which rank first among all the shrines of Japan in point of sanctity, but not in point of antiquity. These shrines are annually visited by tens of thousands of pilgrims, who return with charms (consisting of chips of the wood), to be placed in the little shrine which stands on the *Kami-dana*, or 'god-shelf,' found in every Japanese house. Every six months there is a great festival, which is supposed to effect the purification of the whole nation from the sins of the preceding six months, and the possessor of a fragment of the cedar wands used in these festivals is protected from misfortune for the next six months. For a full account of the buildings, their arrangements, ceremonies, and the gods here honored, see the paper by Sir Ernest Satow in vol. ii. of the *Transactions of the Asiatic Society of Japan* (Yokohama, 1874).

ISEGHEM, ĕ′*se*-gĕm. A town of Belgium, in the Province of West Flanders, situated 23 miles by rail from Bruges (Map: Belgium, B 4). It manufactures woolen, linen, and lace. Population, in 1890, 9965; in 1900, 12,160.

ISEGRIM, ĕ′*ze*-grĭm, **ISENGRIM**, **ISGRIM** (MHG. *Isengrīm*, Iron helmet). In German animal-epos, the name of the wolf.

ISELIN, ĕz′lăN′, Henri Frédéric (1825—). A French sculptor, born at Clairegoutte Haute-Saône. He studied his art under Rude in Paris, and speedily made a name for himself by his portrait busts, which he exhibited at the Salon in 1849. His "Jean Goujon" (1852) was bought by the nation, and other samples of his work are to be seen in the museums of Rouen and Versailles, the Luxembourg, the Paris Opera House and Hôtel de Ville, the Louvre, and elsewhere. Each is marked by sympathetic delineation of the character of the person represented, whether it be President Boileau, Napoleon III., Augustin Thierry, the Duke de Morny, or Admiral Montaignac. M. Iselin received several medals and the cross of the Legion of Honor.

IS′ENBRAS, or **IS′UMBRAS**, Sir. A hero of mediæval stories, originally presumptuous, but humbled by adversity.

ISEO, ē-ză′ō, Lake, called also Lake Sebino (Lat. *Lacus Sevinus*). A lake in Lombardy, North Italy, 15 miles northwest of Brescia (Map: Italy, E 2). It is 605 feet above the sea, 15 miles long, from 1 to 3 miles broad, and its greatest depth is 820 feet. In shape it resembles the letter S. Through it flows the Oglio. In the middle of the lake is an island two miles long, culminating in Mount Isola, 1965 feet above the sea. The population of the island in 1901 was 1290. Along the east side of the lake, over deep valleys and through lofty galleries, runs the highway from Iseo to Pisogne. North of the lake are to be seen the snow-covered Adamello Mountains. A steamer connects Sarnico and Iseo at the southern extremity of the lake with Pisogne (q.v.) and Lovere at the northern extremity. Iseo, which in 1901 had a population of 3060, markets wine, grain, olives, and chestnuts; it dyes and spins silk. There are ancient walls and a castle, and a communal theatre. Lovere, which in 1901 had a population of 3344, markets wine and cattle and spins silk. Its handsome church, Santa Maria in Valvendra, built in 1473, and restored in 1547, 1751, and 1888, contains frescoes by Ferramola and old paintings.

ISÈRE, ē'zâr'. A river of Southeastern France, rising in Savoy, at the western base of Mount Iséran (Map: France, M 6). It flows in a general southwesterly direction through the departments of Savoie, Isère, and Drôme, past Albertville, Grenoble, and Romans, and joins the Rhone four miles above Valence. The upper half of its course runs through a beautiful Alpine region around the foot of La Grande Chartreuse. A railroad follows its valley, which is the principal route to the most important Alpine passes south of Mont Blanc. The entire length of the Isère is about 180 miles, for the last 90 of which, from Montmélian, it is navigable, but with difficulty, owing to its rapid flow and shoals and islands.

ISÈRE. A southeastern department of France, bounded on the north and west by the river Rhone, on the east by the Department of Savoie, and on the south and southeast by those of Drôme and Hautes-Alpes (Map: France, M 6). Area, 3201 square miles, of which nearly a half is arable land and a fifth under forest. Population, in 1896, 568,933; in 1901, 568,693. The surface is level in the northwest, but mountainous in the south, where the scenery is very imposing. Mont Olan, on the southeastern border, is 12,664 feet high. The chief rivers, besides the Rhone, are the Isère, from which the department derives its name, and its affluents, the Drac and Romanche. The department is one of the richest in France in mineral products. Mines of iron, lead, silver, coal, and marble are worked. The vine is carefully cultivated in the valleys. Capital, Grenoble.

ISÈRE, COLOMBAT DE L'. See COLOMBAT DE L'ISÈRE.

ISERLOHN, ē'zẽr-lōn. An important manufacturing town of the Prussian Province of Westphalia, situated on the Baar, 15 miles by rail from Hagen (Map: Prussia, B 3). It manufactures chiefly needles, bronze, silver, and nickel wares. Population, in 1890, 22,117; in 1900, 27,265.

ISERNIA, ē-zĕr'nē-ȧ. A city in the Province of Campobasso, Italy, 79 miles north of Naples, 1495 feet above the sea (Map: Italy, J 6). The ancient Samnite Æsernia was important because of its strong situation on an isolated hill. There are remains of the ancient Cyclopean walls and of an aqueduct. Isernia manufactures linen and pottery. Population (commune), in 1881, 9015; in 1901, 9322.

ISERT, ē'sērt, PAUL EDMUND (1757-89). A Danish traveler. He went to the possessions of Denmark in Africa (1783) as chief surgeon at Fort Christiansborg, on the Guinea Coast, and three years afterwards, because of having cured the sister of the Ashantee King, he was allowed to make extensive journeyings through the King's domain. He collected interesting details of native life and manners, and also visited the Antilles before returning to Denmark (1788). He was intrusted with the establishment of a colony in Africa, and made an attempt upon the island of Rio-Volta, near Malfy; but he removed to Guinea, where he and most of his company died of fever. The letters he had written to his family and friends were published at Copenhagen (1788), under the title *Reise nach Guinea und den Caraibischen Inseln in Columbien*. They are also contained in the Danish collection of Gyldendal (iii., 1790), and translated into Dutch, Swedish, and French.

ISEULT, ē-so͞olt', or **ISOLD.** A character in mediæval romance. The name occurs in a great variety of forms. (1) Iseult the Fair, wife of Mark, King of Cornwall, who through philter is made to love his nephew, Sir Tristram. (2) Iseult of the White Hands, a princess of Brittany, the wife of Sir Tristram. See TRISTRAM.

ISH'BAN. A character meant for Sir Robert Clayton, in Dryden's *Absalom and Achitophel.*

ISHBO'SHETH. (1) In the Old Testament, a son of Saul. (2) A character representing Richard Cromwell in Dryden's *Absalom and Achitophel.*

ISHIM, ē-shēm' (Kirghiz *Isel*). A river of Siberia, the most important left affluent of the Irtysh, rising in the eastern part of the territory of Akmolinsk (Map: Asia, F 3). It flows in a westerly and then northeasterly direction till it empties into the Irtysh, after a course of about 1500 miles. It is free of ice about 190 days in the year, but is navigable for only 100 miles. It passes the towns of Akmolinsk, Petropavlovsk, and Ishim. The Trans-Siberian Railway crosses the river at Petropavlovsk.

ISHMAEL, ĭsh'mȧ-ĕl (Heb. *Yishmāʽēl*, God hears). The elder son of Abraham, and reputed founder of the Arab race. His story is given in Genesis xvi. and xxi. Modern critics hold that it is compounded of two sources, and furnishes a good illustration of the way in which the writers of the Bible gave to tribal likes and dislikes the form of personal history. It is said that Sarah, being barren, gave Hagar, her Egyptian handmaid, to her husband Abraham. When Hagar saw that she was with child she began to despise her mistress, and as a result was harshly treated. This compelled her to seek refuge in flight; but at the advice of an angel, who foretold the birth of a son, and also his character, she returned. The child is born, and at the age of thirteen is circumcised. By this time Isaac was already born, and Hagar is driven out again with her son. The provisions given her by Abraham did not last long, and she had given up hope when an angel pointed out a well of water. Ishmael grew and dwelt in the wilderness of Paran, living by hunting. He married an Egyptian woman.

Scholars of the critical school consider Ishmael, as thus portrayed, the personification of a group of tribes who were akin to the Hebrews, and who at one time proved to be serious rivals. In making Ishmael the son of a bondmaid the tradition reflects the Hebrew point of view, and it is noteworthy that among the Arabs, who regard themselves as descendants of Ishmael, it is Hagar who is the true wife of Abraham, and Ishmael is the favored son. (See HAGAR.) The home of the Ishmaelites was the wilderness to the south of Palestine, as far as the frontier of Egypt. Hebrew tradition accounts for this by having Abraham drive Hagar and Ishmael into the wilderness; but it is interesting to note that, despite the Hebraization of old tribal traditions, certain phases favorable to Ishmael could not be entirely obscured. Yahweh is introduced as the protector of Hagar and Ishmael. Power is promised him and success in war, and his name ('God hears') also points to the excellent terms of his relationship to the deity. In the representations of Hebrew writers a considerable section of Central and Northern Arabia is occupied by Ishmaelites. Their spread over this large territory is indicated in tradition by making Ishmael the father of twelve sons (Gen. xxv. 13-18). Hence we find among the Ishmaelites representatives of both types of the Arab—the fierce Bedouin and the Arab on the road to civilization, even engaging in commerce. According to one form of the Joseph story (Gen. xxxvii. 25, Yahwistic, see JOSEPH); Ishmaelitish merchants carrying spices from Gilead bring Joseph to Egypt. This connection of Ishmaelites with Egypt is also introduced into the narrative which records that Hagar was an Egyptian and makes Ishmael also marry an Egyptian woman. It should, however, be added that the term Ishmaelite, like the term Midianite, comes to be used vaguely by Old Testament writers, and no conclusions are to be drawn from such usage as to genealogies of Arabic tribes. In a general way it was recognized that the clans of Arabia and the clans of Palestine were closely akin, and this was represented in tradition by tracing them back to the same ancestor, just as in another stratum of tradition Hebrews and Edomites are traced back to Jacob and Esau, who unite in the person of Isaac. See EDOM; JACOB; ISAAC; ESAU.

ISHPEMING, ish'pê-ming. A city in Marquette County, Mich., 15 miles west of Marquette; on the Chicago and Northwestern, the Chicago, Milwaukee and Saint Paul, and the Duluth, South Shore and Atlantic railroads (Map: Michigan, F 2). It is in the great Lake Superior mineral region, and is the centre of the iron-mining district of the Marquette Range. Its interests are principally in iron-mining, but gold and marble also are found in this vicinity. Settled about 1857, Ishpeming was chartered as a city in 1873. The government is administered, under a charter of 1891, by a mayor, annually elected, and a common council, of which the executive is a member. Population, in 1890, 11,197; in 1900, 13,255. 1913 - 17.000

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